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PIPE LINE INDUSTRY

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HELICOPTER PAYS OFF
Aerial Stringing of 24-in. Pipe in Marsh 36

SAFETY PROVEN
Synthetic Lubes for Turbine Stations 38

COST CUTTER
New Way to Compact Backfill for Roads 44

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JUN 20 1960

PIPE LINE INDUSTRY

CONTENTS and Quick Look

A GULF PUBLISHING COMPANY PUBLICATION

June 1960 Vol. 12, No. 6

To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.

Helicopter Speeds Stringing on Trunkline's Marsh Work

☐ How practical is a helicopter for stringing pipe? Working in marshy terrain in Texas, a helicopter was used to string 3,200-pound joints of 24-inch pipe on a 2.3-mile section of Trunkline's new loop. Cost ranged from 41 to 75 cents per foot. Helicopter stringing efficiency reached a peak rate of 21 joints an hour. Here is a rundown on some advantages, costs and difficulties in stringing with helicopters.

By Donald G. De Pugh ..... Page 36

Synthetic Lube Oil Reduces Fire Hazard at Gas Turbine Stations

☐ Esters and ester-base lubricants that have a high degree of fire resistance are proving valuable at Texas Eastern's large unattended turbine stations where fire hazard in event of malfunction is great. The synthetic lubricants not only reduce the fire hazard, they are doing a fine lubrication job.

By Oliver M. Fletcher ..... Page 38

Low Cost Way to Compact Backfill on Highway Crossings

☐ Shop-made sheepsfoot rollers solved Houston Natural Gas Corp.'s problem of compacting backfill to the satisfaction of engineers directing the huge interstate highway program in Texas. What's more, compacting the backfill with the rollers requires less labor and less equipment than most other methods; the cost is considerably lower and results are superior to any other method tried.

By W. C. Dahlman ..... Page 44

Tank Trucks Load Products Directly From Pipe Line

☐ Standard Oil Company (Indiana) has devised a means of loading tank trucks on the fly as a products tender flows past the Trenton, Mo., terminal. This unusual terminal has no expensive tankage with its attendant evaporation and upkeep. The company plans four more such terminals for this year..... Page 46

Pump Station Operates Unattended Without Communications!

☐ This is the latest advance in automation. A power level controller with built-in logic selects power level of station, selects and sequences pumps to minimize throttling and surges on the system. In five months' unattended service, the system has met all the line upsets engineers could devise.

By R. D. Pfluger ..... Page 48

Newest Control Idea: Local Automation, Remote Supervision

☐ Colorado Interstate's new system controls all station functions and operations locally with closed circuit instrumentation. The dispatcher at the control center can monitor operations and can get the desired station discharge pressure remotely via microwave radio. Thus, the station is not subject to the disadvantages of communication outage.

By Donald M. Taylor ..... Page 55

Inert Smoke "Plug" Saves Gas in Line Purging

☐ By injecting a slug of dense white smoke ahead of purge gas, the large amount of gas often wasted in purging air from a gas line prior to commencing operations is conserved. The smoke is white, non-toxic and non-corrosive. It takes the guesswork out of the frequent hit-or-miss methods of detecting the arrival of gas at the downstream section of line.

By Clinton McClure ..... Page 66

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Where Will Your Young Men Be Going?

"WITH COMING CHANGES in operations caused by modernization and automation, how are pipe line companies going to select—and keep—key men for the future?"

This challenging question was asked many times over at this Spring's major industry meetings—the API Pipe Line, SGA and AGA Transmission. However, the query wasn't heard as often among the leaders of the "young" pipe line companies; those which were born after World War II, have grown rapidly, and generally speaking started with young men.

For the many older pipe line companies, this appears to be a serious problem. Some have solved it, several are now meeting it, and still others are watching carefully for future changes. Judging from remarks overheard, there isn't an easy solution. But, stated simply, the answer pipe line company management must come up with is to present an opportunity for creative advancement to the best young men in the company and at the same time retain the experience and good judgment of its more experienced supervisory people.

Ignoring the problem won't solve it, nor will haphazard personnel selection based solely on seniority, friendships, or personal prejudices. During the recent Southern Gas Association meeting in Galveston, we had an opportunity to talk with gas leaders on this subject. The outstanding men who have made the gas industry, and indeed the entire pipe line industry grow during the past 20 years possessed four particular talents in abundance. Intelligence—imagination—initiative—and strong individual personalities.

If these talents have made for success in the peak period of industry growth, it seems more than an even bet that they might be able to solve most of the problems of the future. Intelligence should be the easiest of these to judge; the personnel records of most companies plus observations of management should make this measurement comparatively easy.

Imagination is not so easy to grade but there are good indicators. How does this supervisor or engineer react to unusual situations and developments? How curious is he about related technical problems outside of his own immediate responsibilities? Have any of his solutions to problems taken an unexpected tack and have they been successfully carried out, or at least not found unreasonable on thorough examination? What about his vision of company activities and the industry picture five or ten years from now?

There are many other questions. If a person scores high on all of them (or low) it will be a good bet that he will do the same in the future.

Initiative, if this word is not indecent in this age of letting someone else exercise his charity by taking care of you, must be found in the future leaders of the industry at all levels. Even automatic controls, perfect communications and instrumentation will not do away with the need for it. On the contrary, they will make initiative more essential because the entire order of operations and engineering will be upgraded; each human decision and its timing will become even more important. Design, engineering, maintenance, and operations supervision will become much more creative and precise.

As for individualism, perhaps the theme of Kansas City Mayor Roe Bartle, principal speaker at the SGA, best defines it . . . "Stand Up and Be Counted." There has been too much emphasis in recent years on the ability to conform in thought, words, and action. Industry leaders of the future, as of the past, will have to be men who don't wait for the "party line" from Washington or somewhere else. In selecting for the future, management will need to pick men who can disagree when they believe a moral or reasonable principle is involved, but who are not at the same time disagreeable by personality.

This isn't meant as a "ditch the oldsters" approach. Vision of the future is not a matter of birthdate; most of us have seen people twice our age who have all the qualities for future leadership, while some half our age may have none of them. Imagination, initiative, zest for living make the one person young; cynicism, apathy, laziness, and bitterness will make the other ready for the grave before life really begins.

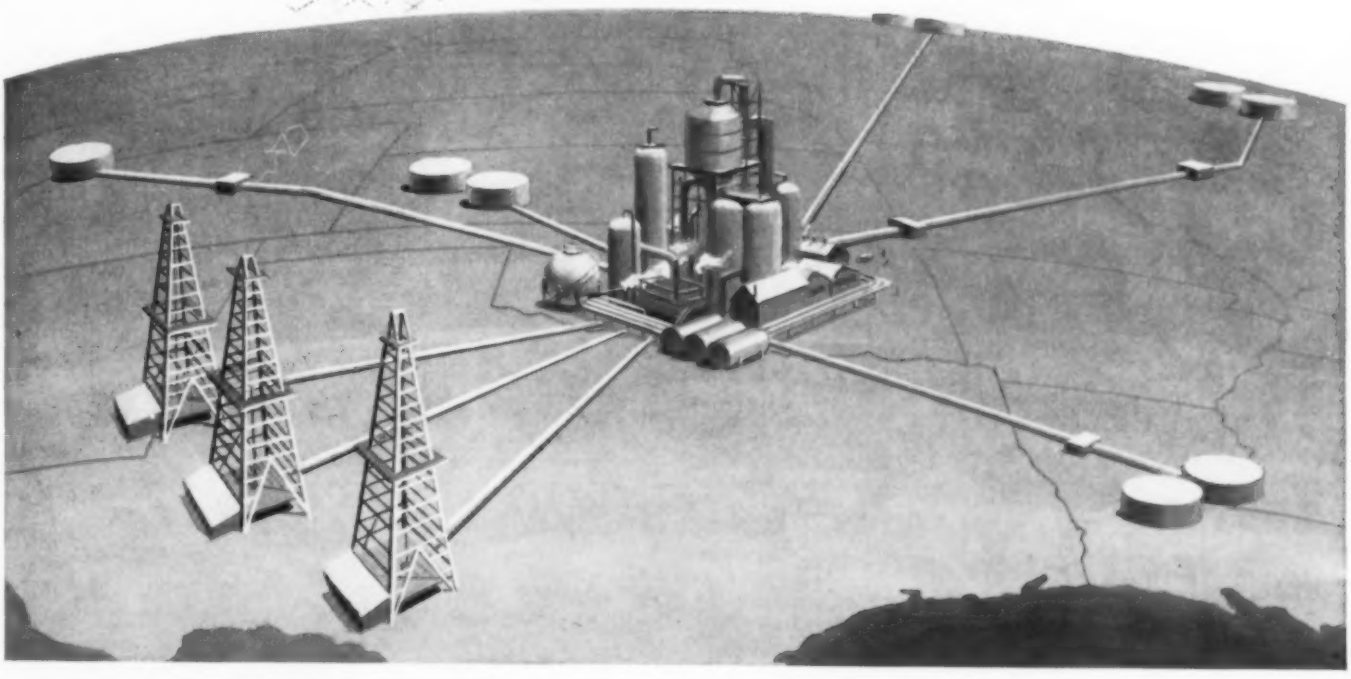
Industry can surely make good use of a large number of veteran employes by making use of their wisdom, judgment and understanding of human nature. But at the same time, those beneath them will have to learn how to make decisions and there is only one way to do it; that is by making them.

Where will your best young men be going? Will it be to responsible, creative and productive jobs in your own company, outside to a better opportunity, or to seed in a dull job without challenge?

Melvin A. Judah

Link Industrial Control Systems Engineering...

SIMULATING PRODUCTS PIPELINES WITH LINK Dialog*



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For specific details on Link Dialog Pipe Line Simulators, write to J. C. Croft, Jr., Manager, Industrial Control Products, Link Division, General Precision Inc., Binghamton, N. Y

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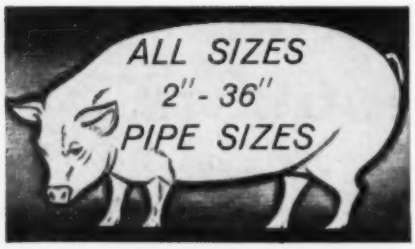
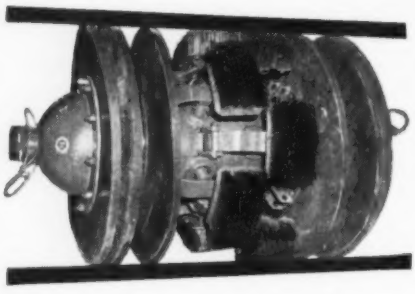
MYOCO PIPELINE PIGS



ANY COMBINATION ALWAYS IN STOCK



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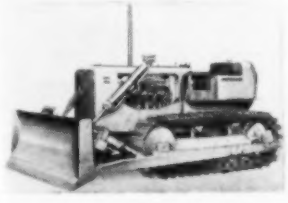
WHY GEORGE PEASE USES

D6s for SITE PREPARATION

THIS is one of 60 sites recently prepared by George W. Pease for a large oil company. The location: Osage County, Oklahoma. The job at each site: leveling an area about 85 feet x 130 feet for drilling rig and equipment and digging a slush pit 70 feet square and 5 feet deep. Depending on conditions, it took the Cat D6 Tractor with No. 6S Bulldozer from one to three days to prepare a site.

Why did George Pease choose the D6? An important reason, he'll tell you—"It stands up better than competitive machines." His is no snap judgment, for he's a veteran with 16 years' experience in the business. Ask others like him, who make their living in the same kind of tough work, and you'll hear the same verdict on the D6.



NOW THE NEW D6 SERIES B

Stacked against the previous model—or against any tractor of comparable size—the new D6B is even further out front from every angle: greater production, low-cost operation and time-saving maintenance. Some reasons why:

NEW ENGINE—A Cat D333 Diesel Engine (93 flywheel HP) delivers 25% more lugging ability. New direct-acting governor for quick fuel adjustments handles loads faster.

NEW INTEGRAL HYDRAULIC SYSTEM—Under-the-hood mounting of tank, pump and valves permits convenient routing of hydraulic lines to bulldozer or implement cylinders, frees front and rear for other equipment.

NEW OPERATOR CONVENIENCE—An all-new cockpit has coordinated controls that make the tractor operate almost as if it knew what was needed next.

NEW 8-FOOT BULLDOZER BLADE—This shorter straight blade combines productive capacity with narrow width. No highway permit is required to move machine from job to job.

And that's not all. The new D6B also features dry-type air cleaner, hydraulic track adjusters (optional), lifetime lubricated track rollers, the oil clutch and forward-reverse lever. Get the full details from your Caterpillar Dealer. Ask him to *show* you how the new D6 can step up production on your job!

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

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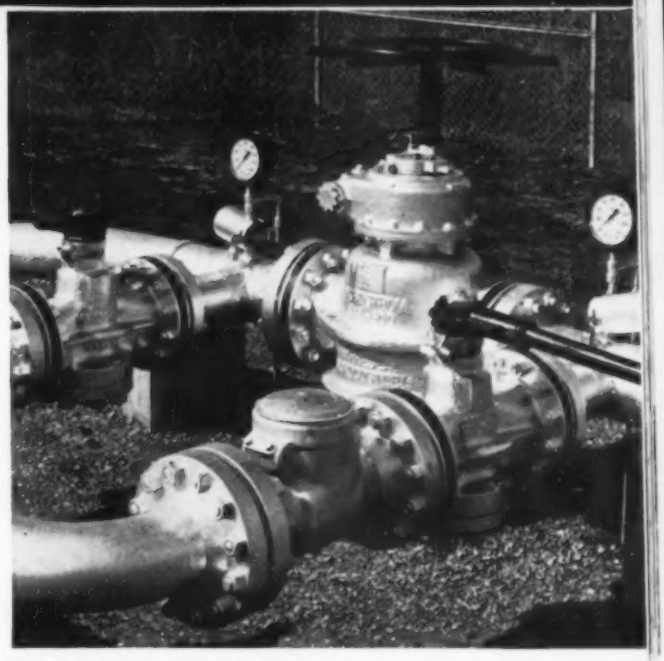
Leading pipeliners expect — and get — performance-proved products from their local Jones & Laughlin Supply Store or office.



The Sealdport® pressurized lubrication system in Rockwell-Nordstrom plug valves actually repairs itself. The lubricant gives a continuous new seating surface. Under pressure, the lubricant is a powerful seal between the body and the plug. Like self-sealing auto tires, this seal can't be permanently cut, scratched or damaged. Rockwell-Nordstrom plug valves offer dependability and economy. Ask your J&L man for a Rockwell-Nordstrom catalog.

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SUPPLY DIVISION – Tulsa

If it's sold by J & L . . . .
It's the best available 106

Left, J&L Electricweld Line Pipe's lengths are uniformly round and line up end to end in perfect butt joints with uniform bevels for fast welding. The uniform high ductility of J&L Electricweld assures easier field bending. Descriptive literature is available from your local J&L man.

Taylor Forge welding fittings are backed by years of engineering and research. Here is an outstanding line of standard and special purpose fittings for pipeline use. The photo, taken at a pipeline station, shows the installation of Taylor Forge ells and flanges on first stage gas scrubbers. Your local Jones & Laughlin representative will be glad to give you illustrated literature on these quality welding fittings.

If you need a brush cutter like this– we've both been missing a bet!

We're a little ashamed to admit we've never tried to sell the pipe line industry these cutters. You see, Servis Equipment Company *originated* the tractor powered brush cutter. And as the picture indicates, ten years later we're still producing the most rugged cutters made.

Sticking too close to the farm has been our trouble. Of course, we *have* sold to state highway departments and to the Air Force, but the red tape was so involved that we found it more efficient to concentrate on the farmers . . . even in South America and Africa.

A pipe liner in West Texas bought one of our Gyro 66 Brush Cutters the other day. It cut up tough mesquite brush on his right of way like nothing had before. He was so enthusiastic, he said we ought to tell other pipe liners about it, gave us the name of this publication.

It's true, Servis cutters will take on the toughest job — we've demonstrated them on a row of 4" x 4" posts. The secret is in low tip speed, but extra heavy blade assembly for tremendous momentum.

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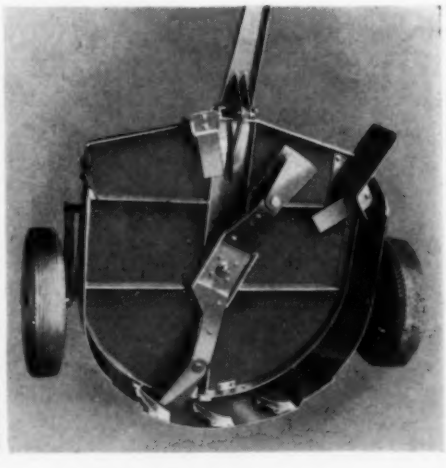
Underside shot shows heavy construction, A-shaped blade carrier, optional extra blades for fine shredding.



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- ☐ E 60" Clipper (Pull & lift models)
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- ☐ Pasture Renovator
- ☐ Whirlwind Terracer
- ☐ Hudson Automatic Row Marker
- ☐ Dump-type Rake
- ☐ Soil Scraper
- ☐ Lone Star Blade (light, 6')
- ☐ 3-Way Ditcher-Terracer Blade, 6'
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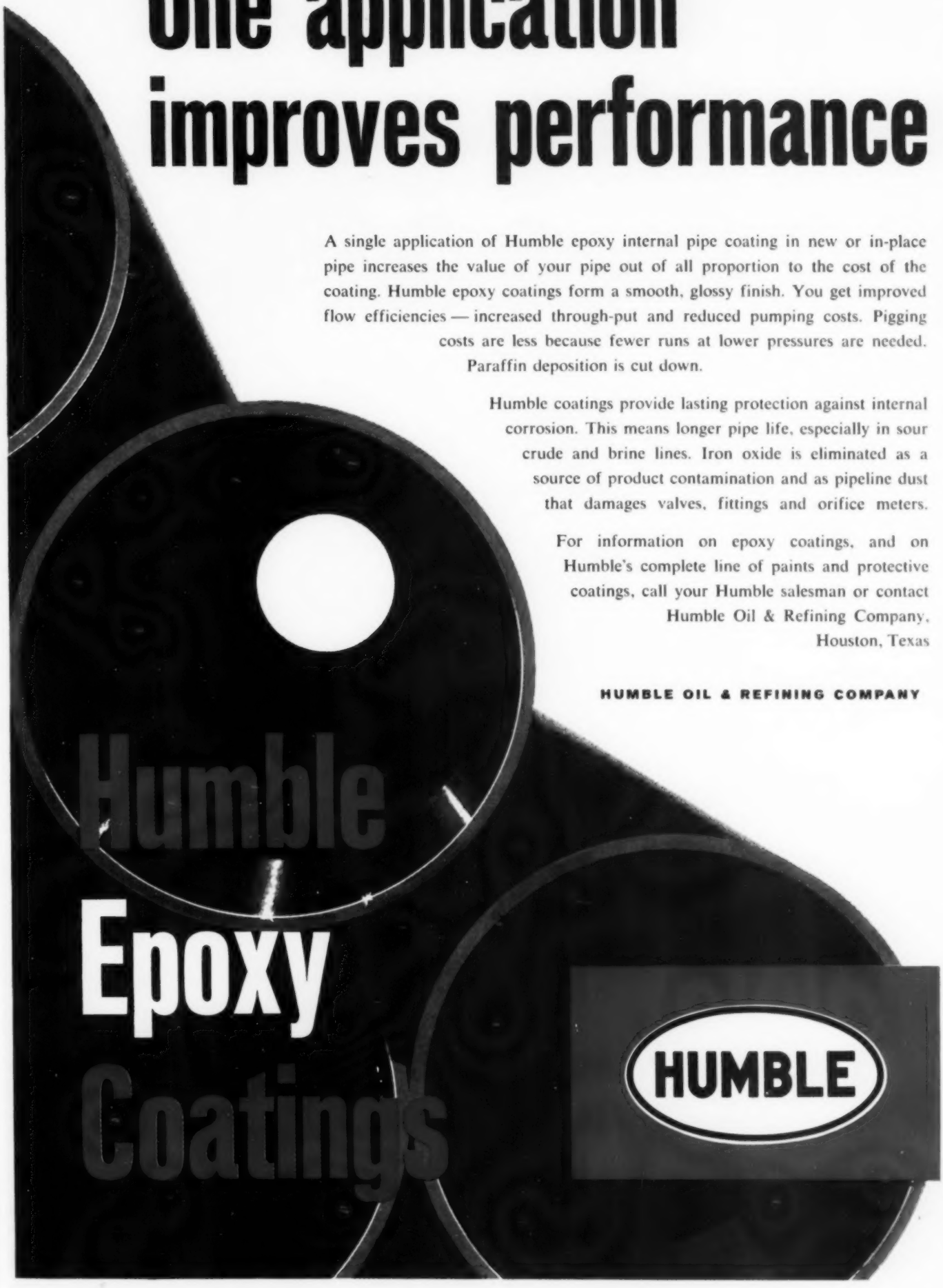
For information on epoxy coatings, and on Humble's complete line of paints and protective coatings, call your Humble salesman or contact Humble Oil & Refining Company, Houston, Texas

HUMBLE OIL & REFINING COMPANY



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Customers can be credited for Union's outstanding position.

Why? Simply because in large numbers they accepted Union's standing invitation to share their wire rope and sling problems with Union's technical, research and engineering staff.

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In searching for better answers to wire rope and sling problems for customers, Union engineers developed the famous family of Tuffy wire ropes and slings.

Each member of the Tuffy family is of a special construction tailored to one of the tougher wire rope jobs. In the Tuffy constructions there is balance—the right combination of strength, flexibility and resistance to wear for better performance and greater safety. When you say Tuffy, you specify the "Ultimate low cost" wire rope or sling.

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Tuffy Balanced Dozer Rope

Big Paul, The King of Spades, world's largest electric power shovel. In taking a 105 ton bite (2 rail carloads) it imposes a maximum bail pull upon the wire ropes of 550,000 lbs. One-half mile of wire rope is required in its operation by the Peabody Coal Company at its modern River King Mine, Freeburg, Ill.

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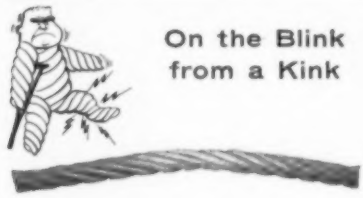
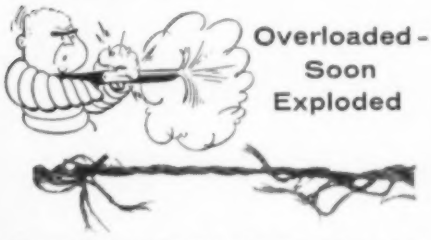
He's selected for his ability and willingness to supply you with the right Union standard or Tuffy wire rope construction, to check for proper installation and coach your operators in proper use to get the ultimate in service life. He is backed up by a nearby Union branch office and warehouse. If you would like to receive Union's Rope Dope Educational Bulletin, write Union Wire Rope Corporation, 2278 Manchester Ave., Kansas City 26, Mo.

Tuffy Wire Rope Tips on Safe Use of Wire Rope and Slings



On the Blink from a Kink

Mishandling of rope caused this open kink. Avoid kinks by proper winding on the drum. Never pull a loop smaller. Enlarge it, then straighten out the rope.



Overloaded - Soon Exploded

The rated capacity of a wire rope is based on breaking strength divided by the load factor for particular type of service. Grade of steel, type of construction and size of rope determine tensile strength. Unless rope is properly related to loads, costly and dangerous early failures are likely to occur.

Mangled in a Wedge Socket

Here's a result of improper socketing, caused by poorly designed or worn-out wedge socket. Can be costly and hazardous!

Victim of the "Bends"

Excessive bending of rope speeds up wear. General rule: use more flexible ropes as bending stresses increase (with decrease in tread diameter of sheave or drum). If sheaves are too small, early rope failure is certain.

Would you like a copy of a booklet in which more than a score of Tuffy Tips like those above are reproduced. If so, write Union Wire Rope Corporation, 2278 Manchester Ave., Kansas City 26, Missouri.

Tuffy Balanced Slings and Hoistlines

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SOONER BOOMER units have been adapted to Ford, International, Case, Massey Ferguson, and other tractors.

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Works faster, harder and longer to help you make Bigger Profits!

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P.O. BOX 8686

Keeping oil and gas *on the move*

Your Profit-Pipe is LIGHTWALL by SOUTHWESTERN

It gives you heavyweight performance for less money: lower initial cost, ease of installation, flexibility, greater flow-through and long trouble-free service.

SOUTHWESTERN gets your order on the way without delay . . .

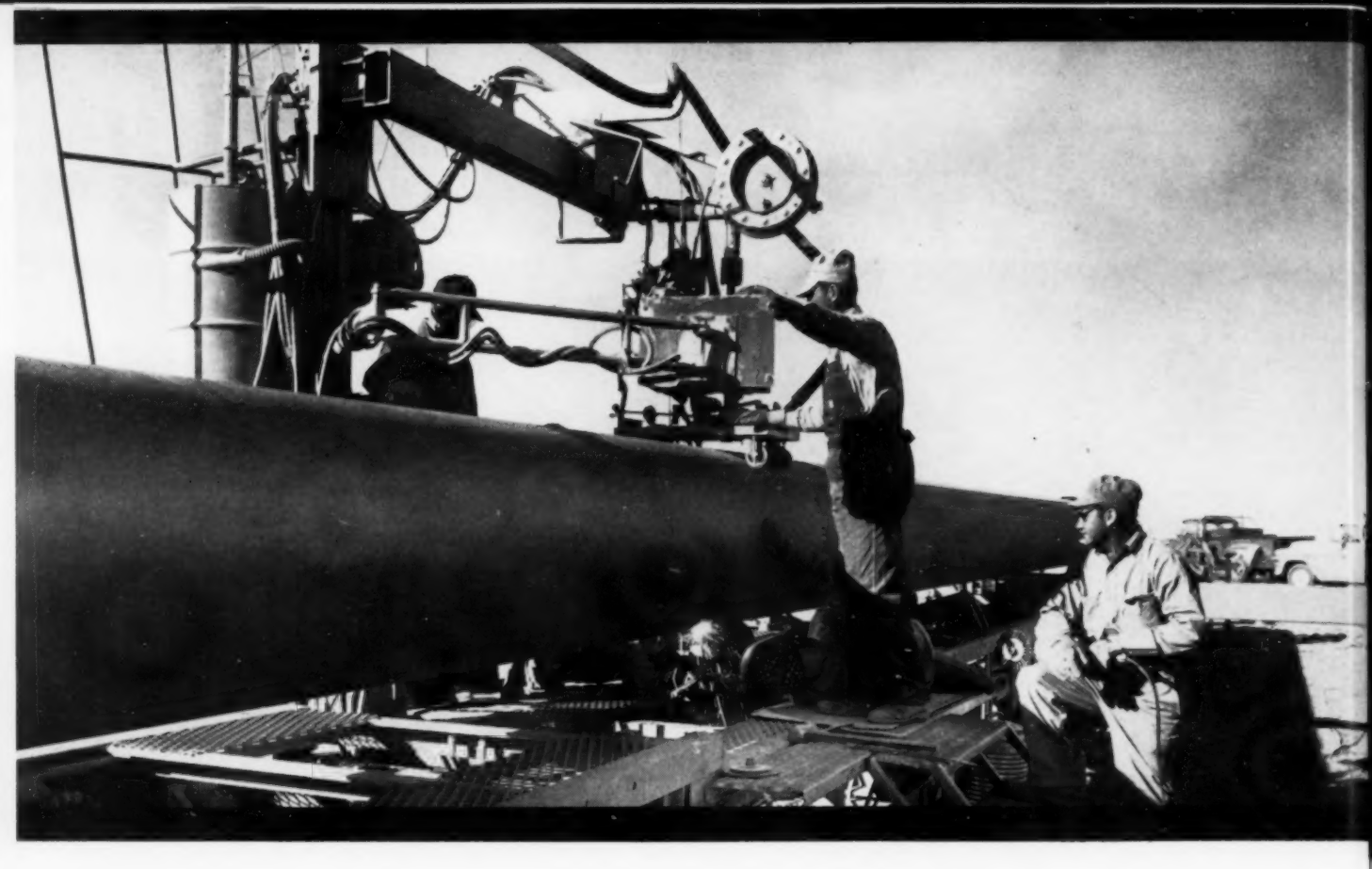
keeping oil and gas on the move. We take pride in our fast, dependable delivery from large warehouse stocks. Southwestern makes a full range of sizes up to 4.500" O.D. in wall thicknesses up to .188 wall to meet almost every need and every joint is top performance quality.

Take a look at LIGHTWALL by SOUTHWESTERN...your Profit-Pipe

LICENSED BY THE AMERICAN PETROLEUM INSTITUTE

SOUTHWESTERN PIPE, INC.

P. O. BOX 2002 HOUSTON 1, TEXAS PHONE CAPITOL 4-0631



Transwestern Pipe Line Company's "big inch" from West Texas to the Arizona-California border is a big job with a big objective —to deliver 300 million cu ft of natural gas per day to Southern California utilities. This calls for the construction of gathering systems and laterals in the Permain Basin of Texas, and in the Panhandle fields. And it requires laying main line of 30 in. OD pipe from Roswell, New Mexico, clear to the California-Arizona border.

Double-jointing in the field

There's plenty of Bethlehem Line Pipe on the job, including the entire distance between Compressor Stations Eight and Nine west of Roswell. On this spread Houston Contracting Company used a new technique—double-jointing the pipe in a yard with special pipe handling and automatic welding equipment. The 80-ft joints mean more footage per truckload, cutting both delivery time and costs. It also resulted in excellent, low-cost welds, with a corresponding reduction in the number of slower, costlier field welds.

Gulf Interstate Company is handling a major portion of the engineering and design of the Transwestern project.

You'll find Bethlehem Line Pipe in all diameters on spreads throughout the land. It's good pipe, made to the highest standards on mills that rank with the finest. We'd be happy to give you more information. Just contact the Bethlehem sales office nearest you.

NOW AVAILABLE IN ALL SIZES MEETING API SPECIFICATIONS

	SIZES (in., OD, incl.)	WALL THICKNESS (in.)	LENGTHS	SPECIFICATIONS
HYDRAULICALLY EXPANDED ELECTRIC FUSION-WELD (submerged arc)	18 to 42	¼ to ¾ incl.	40 ft	API 5LX, Grades X42, X46 & X52 Also X-56
ELECTRIC RESISTANCE-WELD	5⅝ to 16	API	to 60 ft	API 5L, Grades A & B API 5LX, Grades X42 & X46
CONTINUOUS BUTTWELD	½ to 4½	API	SRL 24 to 26 ft DRL to 50 ft	API 5L

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Double-jointing 30-in. steel pipe into 80-ft lengths

speeds Transwestern "big inch" line

Steel *for Strength*
... Economy
... Versatility

Another product frequently seen on spreads in the Southwest is Bethlehem's electric resistance-weld line pipe, available from 5 9/16 in. through 16 in. OD.

It was plenty cold west of Roswell as the coating and wrapping crews "did their stuff."

Why Solar designs industrial gas turbines to weigh between 1 and 1½ lb/hp

by Paul A. Pitt
Chief Engineer
Solar Aircraft Company

The weight of Solar gas turbines is the result of a design philosophy that is unique in the small gas turbine field.

Most gas turbine designs fall into one of two extreme categories. Aircraft-type engines, at one extreme, embody highly sophisticated techniques for extreme light weight in relation to horsepower, but have resulting short life. The opposite philosophy employs the ultra-massiveness of steam turbines to assure long life.

There are important disadvantages in both approaches when long life, reasonable cost, dependable operation, simple maintenance and easy transportation and installation are required. While aircraft-design engines (of ¼ to ½ hp/lb) can be modified and derated for longer service life, the resulting product is inherently delicate. This compromise inevitably results in short life.

Paul A. Pitt

On the other hand, massive design (of 10 lb/hp and up) leads to unnecessary structural bulk and introduces problems of thermal lag and distortion.

Since World War II, Solar has designed and built a variety of gas turbine units with characteristics that lead to both long life and low weight. The Saturn gas turbine engine, for example, is an 1100 hp unit intended specifically for industrial and military installations. It has a weight-to-power ratio of 1.1 to 1.4 lb/hp.

Although it is designed for long life, it utilizes only enough materials in its components to satisfy structural and thermal requirements. This approach resulted in a design that makes no compromises with durability and performance, yet meets the needs of industry for flexibility in a small package. It has an 1100 hp rating at a specific fuel consumption of 0.61 lb/hp-hr and a continuous rating of 1020 hp at 0.63 lb/hp-hr SFC.

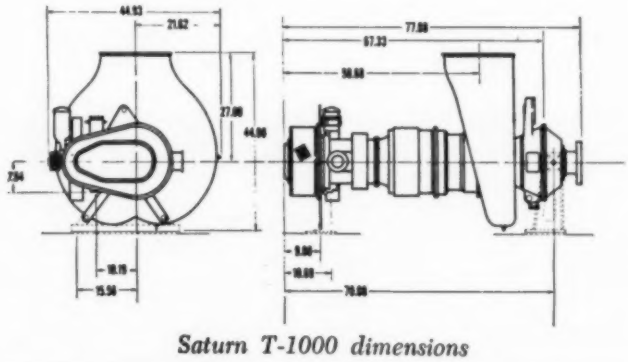
Meeting these objectives required an engine with a simple thermodynamic cycle and high efficiency components. An axial compressor was designed with an operating efficiency of 86%, and this was combined with a multi-stage, axial type turbine of advanced aerodynamic design. Over-all dimensions of the engine are shown in the figure below.

To fulfill workhorse service requirements, the engine was designed to operate at a conservative gas temperature of 1450 F continuous rating. The stress levels are also low, so that major rotating and stationary components will have more than 100,000 hours of life with long periods between overhaul. To keep costs down and assure dependability, the engine design is simple and straightforward.

In brief, the development program of the Saturn turbine adhered to three principles: Careful aerodynamic design for high performance; use of moderate temperatures and low stress levels for long life; and exhaustive component testing for ruggedness and reliability.

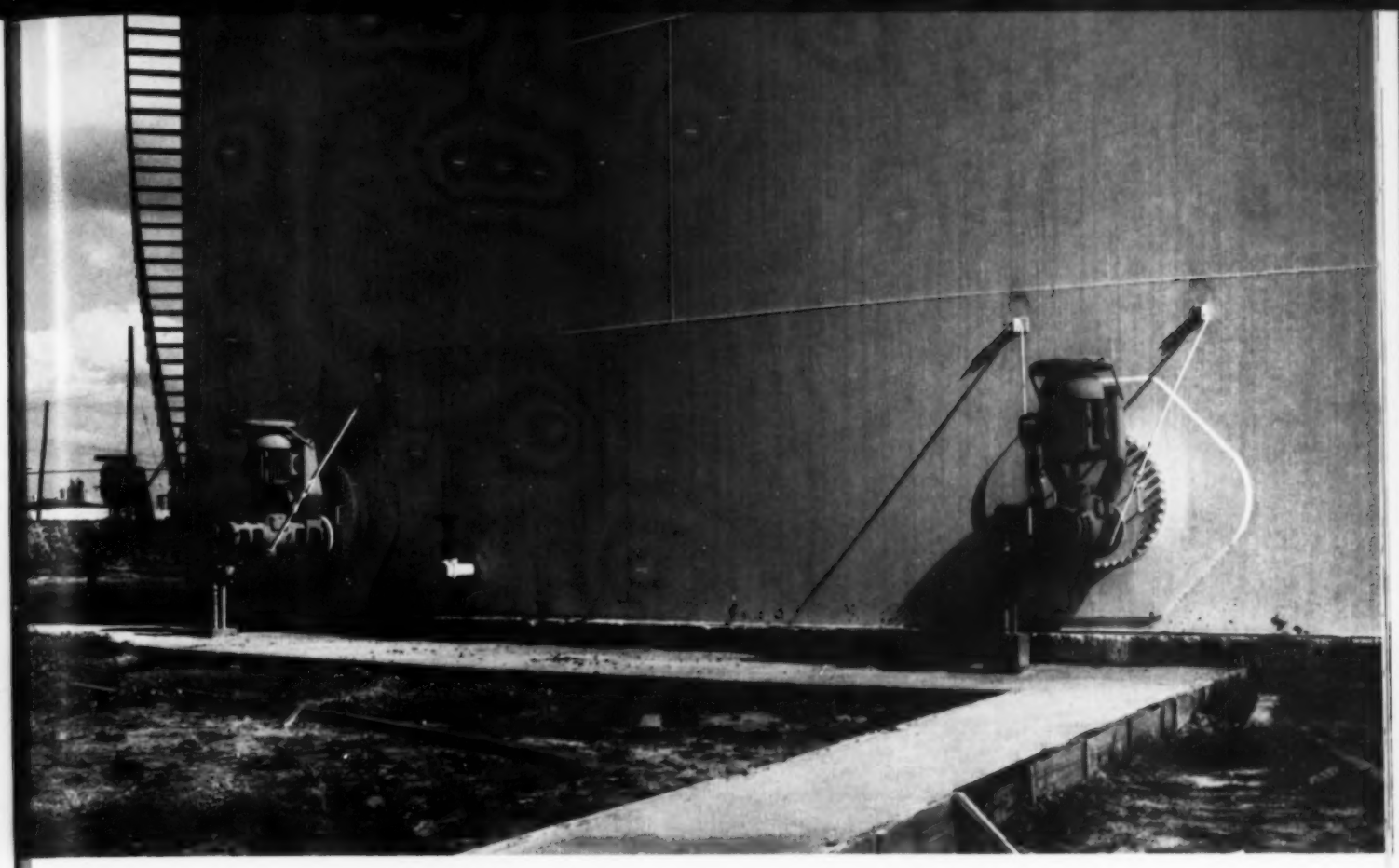
Presently scheduled field applications of the Saturn turbine include: Power source for 750 kw electric generator sets in process plants, portable field equipment, pipeline pumping, and gas compression in the petro-chemical industry. Other uses are as a power source for a 600 kw generator set in a commercial marine installation, propulsion units for marine and amphibious vehicles, and prime movers for off-highway vehicles.

Detailed data on Solar gas turbines and other turbomachinery is available. Write Dept. H-124, Solar Aircraft Company, San Diego 12, California.



Saturn T-1000 dimensions

SOLAR
AIRCRAFT COMPANY



You save $1000 per tank per year

when you keep bottoms clean by pressing a button

Take a minute to add up what it costs you to clean out the sediment in an 80,000-barrel crude storage tank.

The answer—5000 to 8000 dollars—may amaze you. Yet these figures are based on careful field studies by a major pipeline company.

Your total cost includes:

- what you pay for cleaning
- your overhead while the tank is out of service
- value of refinable oil and wax you lose in the bottoms (at least $2000—and sometimes as high as $6000).

Fortunately, this is one expense you don't have to accept. Prevention is easy.

Put LIGHTNIN Mixers on your tanks, and start enjoying savings *on the order of $1000 per 80,000-barrel tank per year.* Savings on larger tanks are equally spectacular.

No need to scrape out sludge

You eliminate sludge buildup—for good—when you install LIGHTNIN Mixers. By pressing a switch button, you start the tank contents in gentle motion that keeps sediment suspended in the crude, or resuspends any that has settled. You can keep bottom sediment level, year to year, as low as *one inch.*

You dispatch a more uniform crude when you use LIGHTNINs in your tanks. Crude leaving the tank has the same values as when it entered the tank. You overcome the risk of large slugs of accumulated sediment breaking loose and moving into the pipeline.

By eliminating downtime for sludge cleanout, you keep your tank farm's *full holding capacity* ready for use when you need it. You gain as much as 12% more storage capacity—without adding a single tank.

Do this today

More than 50 independent pipeline companies and about 35 leading producers and refiners are cutting crude storage costs this effortless LIGHTNIN way. So can you! To see how, just call in your LIGHTNIN Mixer representative (listed in Pipeline Composite Catalog). Or write us direct.

Lightnin® Mixers

MIXCO fluid mixing specialists

LOW OPERATING COST. It takes as little as one hour to suspend sediment in a full tank. Upkeep is simple; choice of stuffing boxes to meet your conditions, or mechanical seals that eliminate stuffing-box maintenance.

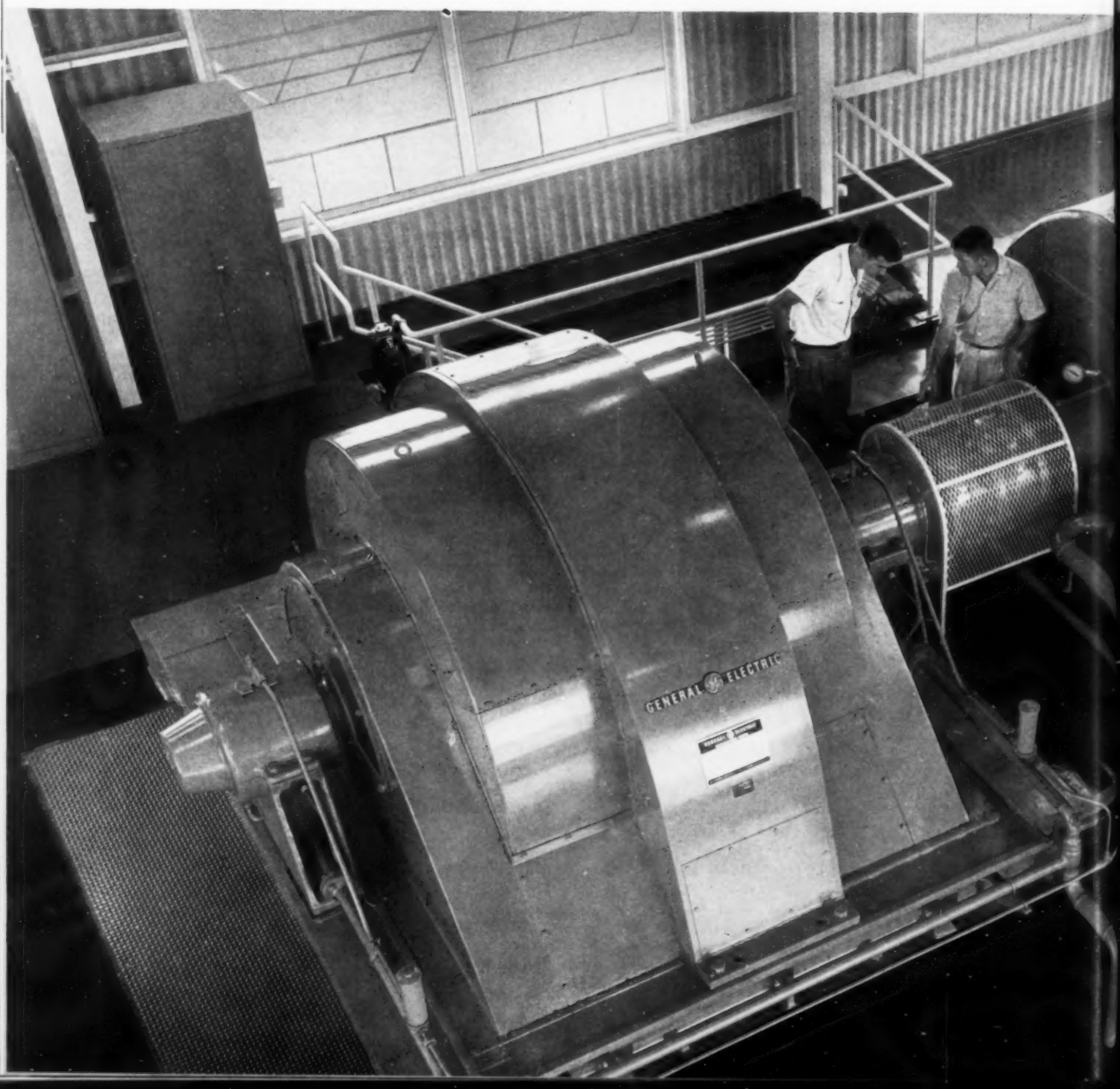
Get these helpful bulletins on BS&W control and LIGHTNIN Mixers. Check, tear out and mail to us today with your name and company address. Free—no obligation.

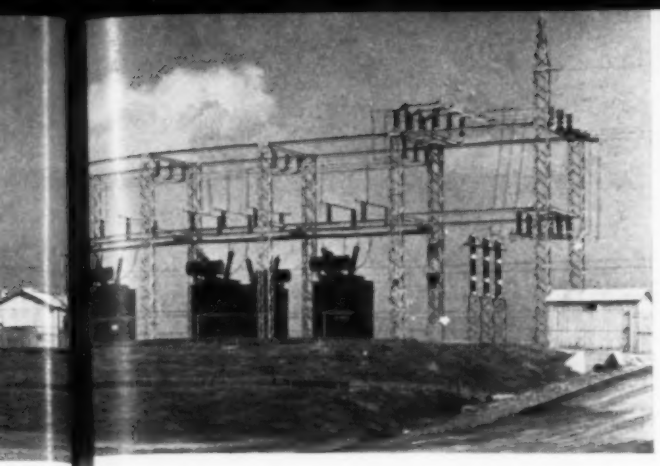
- ☐ BS&W Control with LIGHTNIN Mixers (B-503)
- ☐ Side entering mixers, 1 to 25 HP (B-104)
- ☐ Data sheet for figuring mixer requirements (B-107)
- ☐ Condensed catalog describing LIGHTNIN Mixers—all types (B-109)
- ☐ LIGHTNIN rotary mechanical seals for extra-low-cost mixing (B-111)

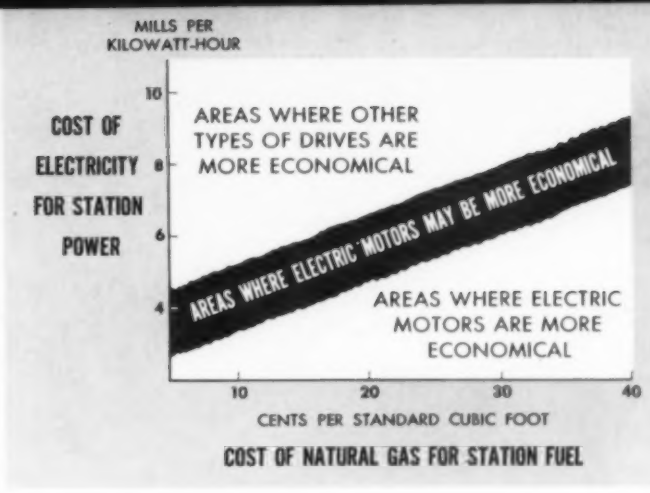
MIXING EQUIPMENT Co., Inc., 196-f Mt. Read Blvd., Rochester 3, N. Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Avenue, Toronto 19, Ont.

Before you select a pipeline



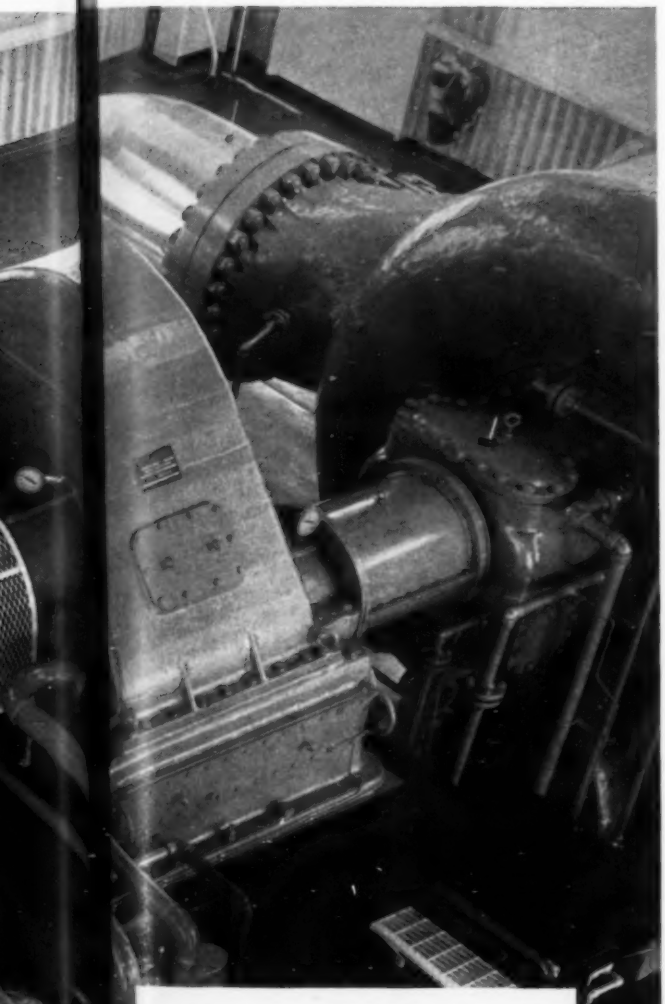




ne compressor drive...

CHECK LOCAL POWER COSTS

WITH LOW-COST ELECTRICITY, GENERAL ELECTRIC SYNCHRONOUS MOTORS ARE YOUR BEST BUY



G-E 12,500-HP SYNCHRONOUS MOTOR and 900/4823 rpm gear driving compressor at new installation in North Carolina. This compressor station boosts typical summer volume of over one billion cubic feet of gas daily.

As the demand for natural gas increases, the use of electric power for driving pipeline compressors becomes more attractive. With low-cost electricity—readily available to pipeline companies in an increasing number of areas—General Electric high-speed synchronous motors give you these important advantages:

MAXIMUM RELIABILITY is inherent in the uncomplicated General Electric synchronous motor. Few moving parts, simple lubrication, and a pressurized air cooling system give you dependable, low-maintenance operation, day after day.

LOW INSTALLED COST is characteristic of compact General Electric motor drives. Initial cost of the G-E synchronous motor is significantly under that of other types of prime movers. And its installation—requiring much less space and foundation for its small size and weight—is simpler, faster, and less costly.

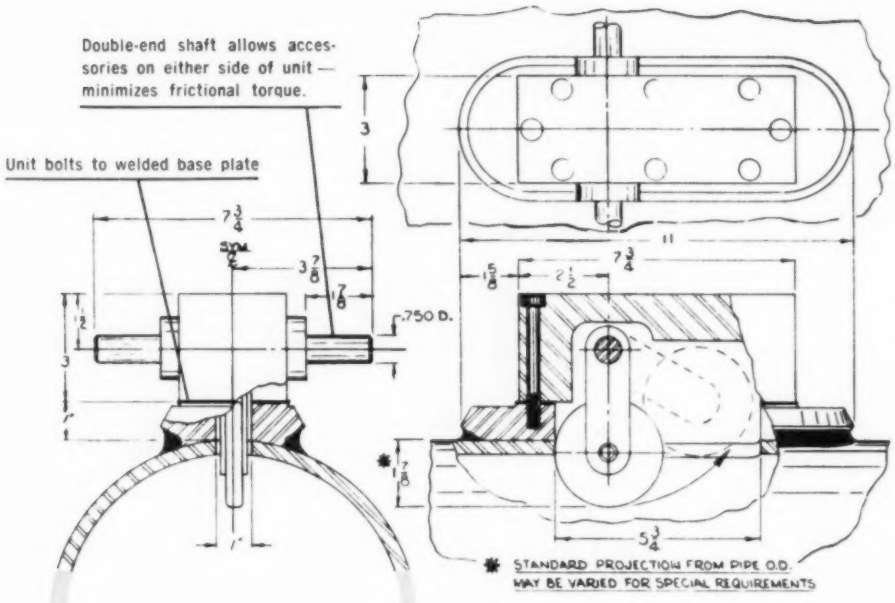
AUTOMATIC CONTROL of the compressor station is enhanced by the simplicity and ease of control of the G-E electric-motor drive. In addition, General Electric can co-ordinate the motor, gear, station control, and remote supervisory control for a completely integrated system which can be operated from miles away.

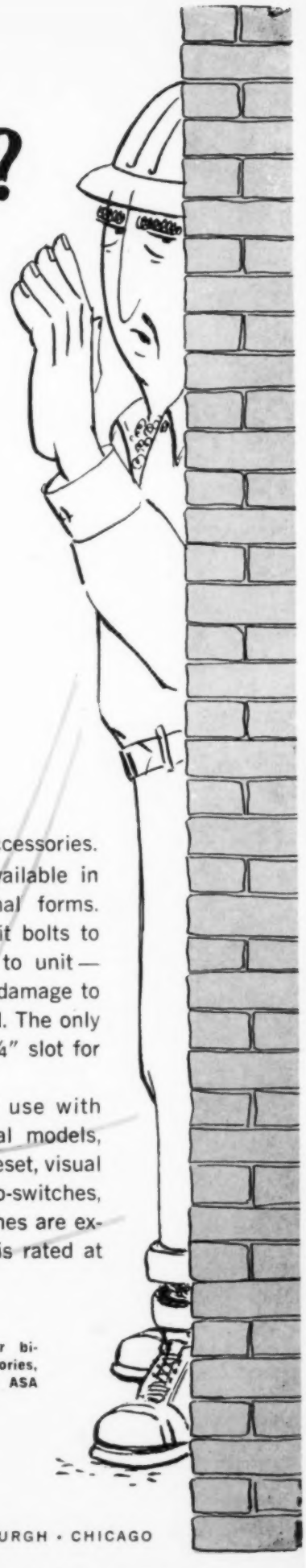
For information on how General Electric can help you analyze the economics of fuel/power costs in the locality of your next compressor station, call your General Electric Apparatus Sales Office or write to Section 661-01, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Need Some Inside Information?


Double-end shaft allows accessories on either side of unit — minimizes frictional torque.
Unit bolts to welded base plate
.750 D.
STANDARD PROJECTION FROM PIPE O.D. MAY BE VARIED FOR SPECIAL REQUIREMENTS



The Maloney SPHERE-HERE will give you it to you

The SPHERE-HERE is a multi-purpose unit especially designed for **precision** detection for use in automated systems involving product separation, on-stream meter-proving and other installations where extreme reliability of operation is desired. The SPHERE-HERE serves in activating switches, counting, timing, or denoting the passage of spheres/scrapers. The design precludes the possibility of a sphere failing to trip the trigger mechanism.

The SPHERE-HERE provides sufficient driving power to operate practically any desired device. Basic design permits an unlimited range of driven accessories. Basic housing models are available in either single- or bi-directional forms. Base plate welds to pipe, unit bolts to base plate, accessories bolt to unit — thus warpage and other heat damage to operating parts are eliminated. The only pipe cut necessary is 1" x 5¾" slot for detector arm.

Accessories, suitable for use with either single- or bi-directional models, include manual or automatic reset, visual or electrical indicators, micro-switches, counters, air valves. All switches are explosion-proof. Standard unit is rated at ASA 600.

F. H. Maloney COMPANY®

TO ORDER: Specify single- or bi-directional model, desired accessories, pipe size and — if other than ASA 600 — the desired ASA rating.

SEE OUR CATALOG IN PIPE LINE CATALOG

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Edmonton, Alberta

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GASO DISTRIBUTORS BRING GASO SERVICE TO YOUR BASE OF OPERATIONS

We screen and pick our distributors with the utmost care. We bring their organizations to Tulsa for thorough training in oil-industry pumps and their application. We insist that they carry stocks of Gaso Pumps and parts.

Result: Complete Gaso service at your doorstep. Time-saving. Convenient. Still another explanation of the worldwide preference for Gaso Pumps.

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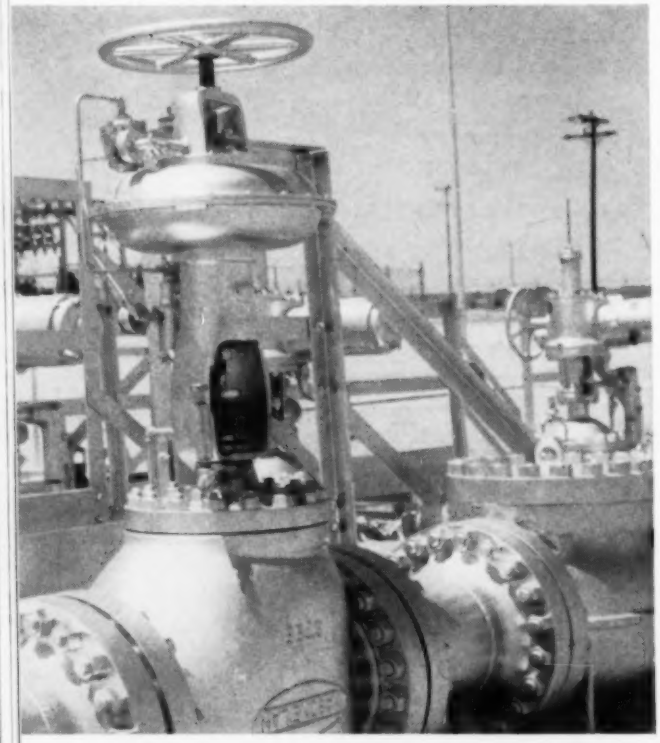
une, 1960

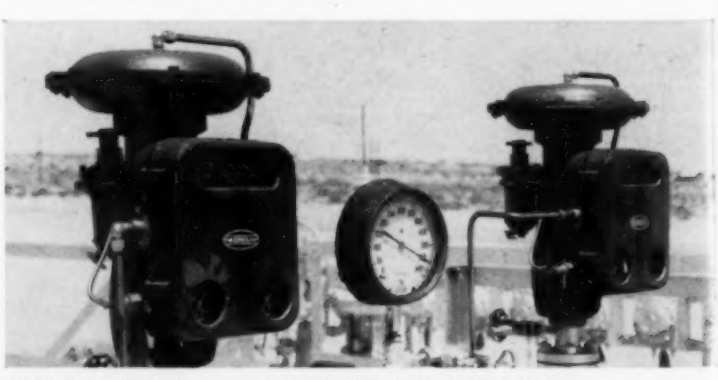
Masoneilan Butterfly Valves, equipped with pneumatic positioner, used on gas pipe line auxiliaries.

Masoneilan Percentage Piston Control Valves with Series 2800 Controllers.

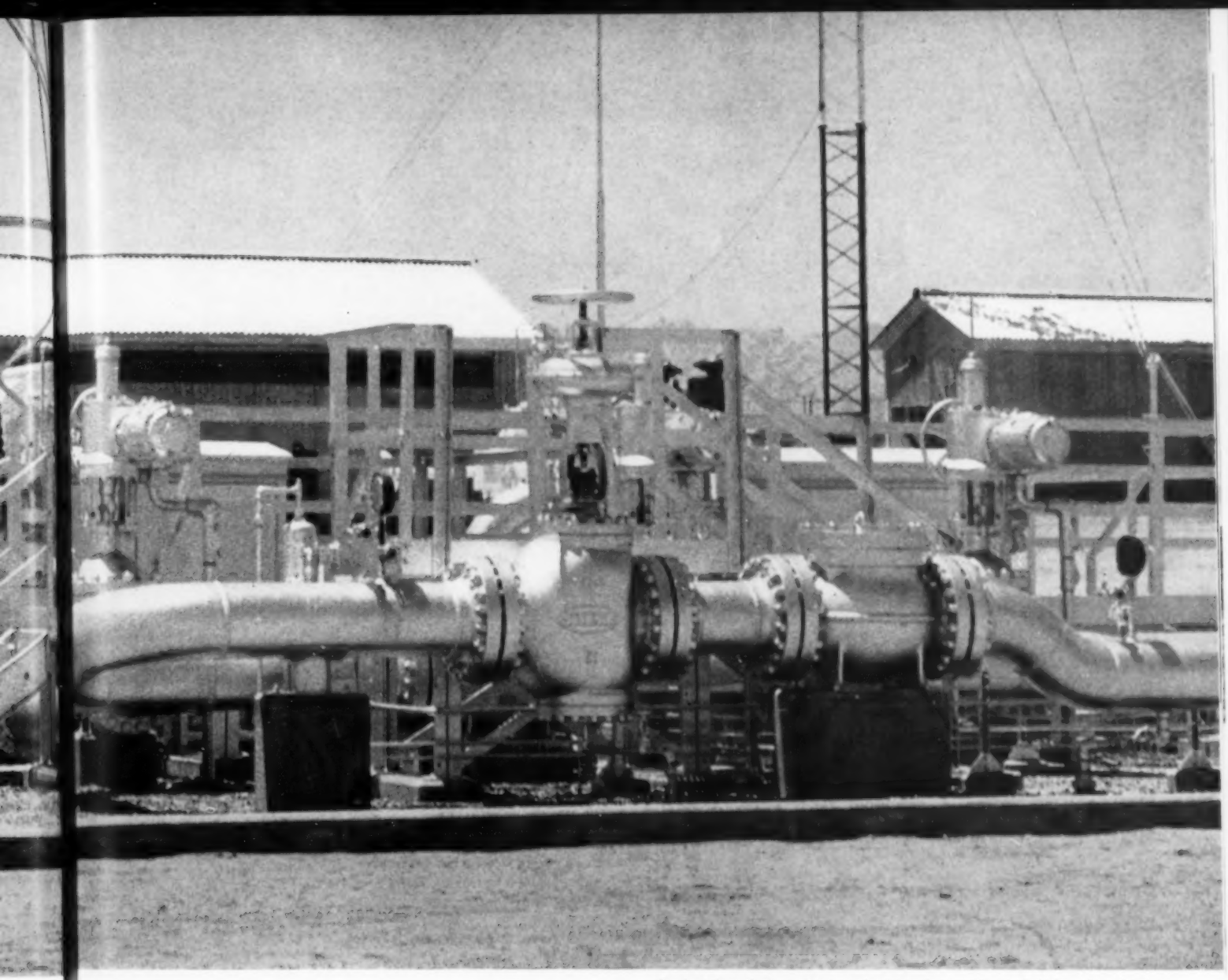


10,000 Series Control Valves at Pipe Line Pumping Station.

Masoneilan Control Valves provide flexibility in obtaining desired pressure differential in friction tube bundles at a Pipe Line Station.



2700 Series Controllers mounted on 10,000 Series Control Valves.



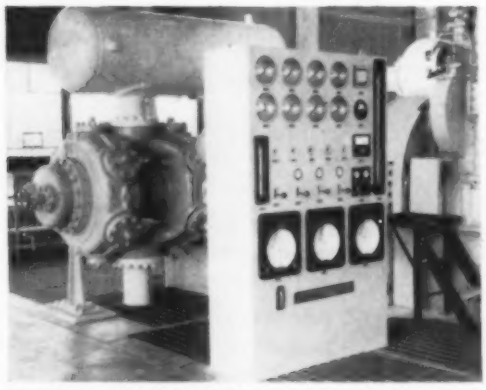
Typical installation of Control Valve for a Crude Oil Pumping Station.

Masoneilan Controls Demonstrate Dependability in Modern Pipeline Operation

Masoneilan Controls — instruments, control valves and auxiliary equipment — are demonstrating the dependable, low-maintenance service required for profitable pipeline operation. Remote station control, and other modern concepts designed to obtain operating simplicity and economy, demand this top dependability.

Versatility in application of standard Masoneilan products affords further opportunities for cost-saving. Extensive pipeline control experience enables Mason-Neilan engineers to exploit this versatility to your advantage.

For product data and application assistance, contact a Mason-Neilan representative, or write:



Masoneilan 60000 Series Instruments are used to control pressure at Compressor Stations for gas pipe lines.

MASON-NEILAN

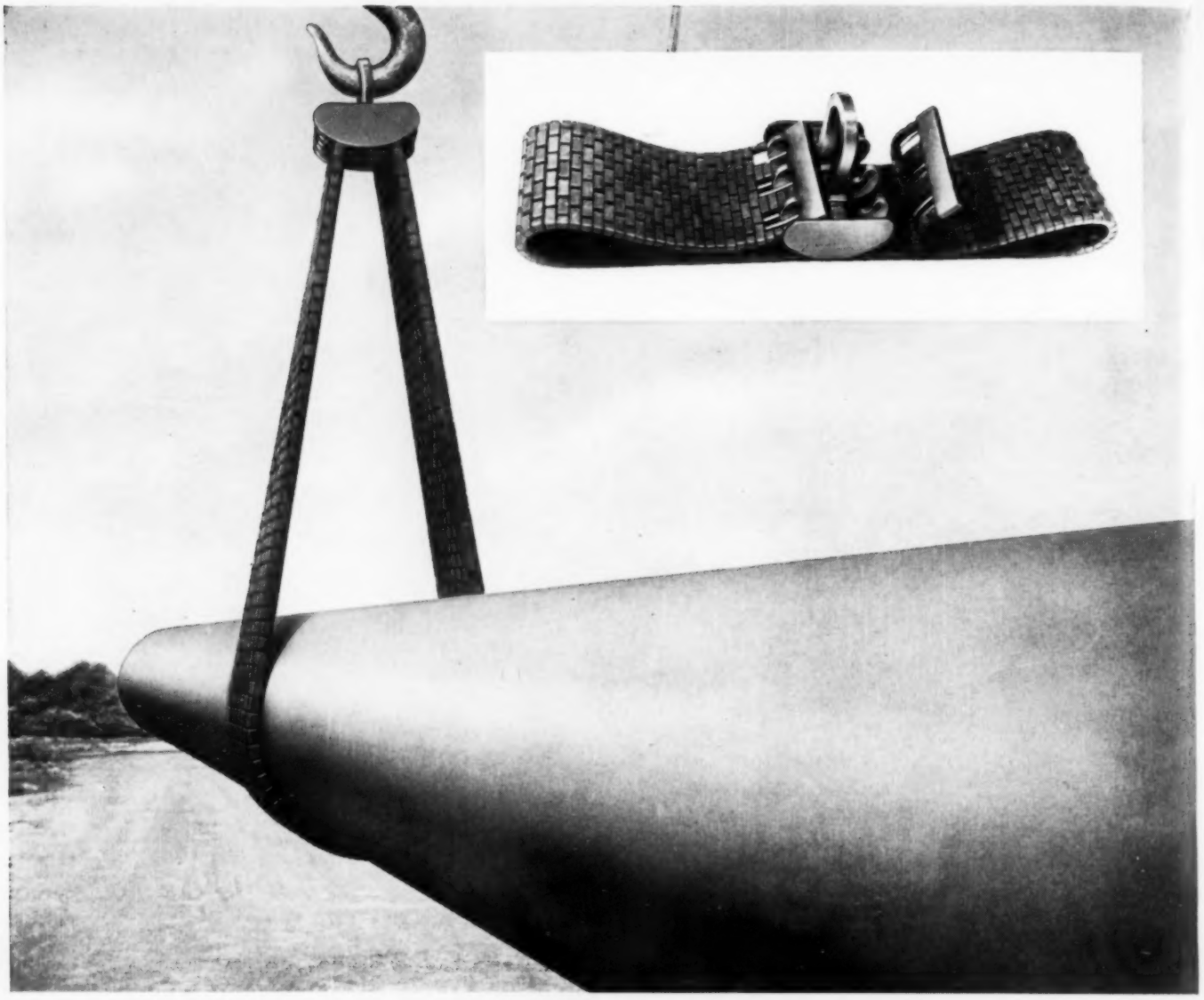
Division of Worthington Corporation

61 NAHATAN STREET, NORWOOD, MASSACHUSETTS, U. S. A.

Sales Offices or Distributors in Principal Cities in United States and Abroad

In Canada: Worthington (Canada), Ltd., Mason-Neilan Division

MN 8-34



This "Swing Sling", 12" in width, was especially designed for handling pipe and other long cylindrical objects. Because of its wide-bearing surface, one sling will usually be enough to handle a standard section of pipe.

Now...you can handle pipe without surface damage using the new "Swing Sling"*

TRADEMARK

CF&I-Wickwire introduces the "Swing Sling" — the only lifting tool of its kind on the market today.

- **The "Swing Sling" can't damage the surface of pipe** because wide-bearing neoprene blocks grip the load gently and lift firmly.
- **It's practically indestructible** ... parallel, high-strength aircraft cables covered with tough, tested neoprene blocks make it a rugged, long-lasting hoisting tool. High strength gives a safe operation.
- **Easy to use** ... light and flexible.
- **Comes in two models** especially designed for hoisting long cylindrical objects. Widths — 12" and 18" ... any length over 4'.
- **Available now** ... write for complete details.

CF&I also manufactures Claymont large diameter API pipe.

7794

*Patent Pending

WICKWIRE Wire Rope Slings

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CF&I STEEL

Available at Pipe Line Service—Harvey, La.

Complete facilities for applying

ANCHORCRETE®

Concrete Coatings

When your pipelines require anchoring to offset buoyancy, remember that Pipe Line Service's Harvey plant is completely equipped to apply dependable "Anchorcrete" reinforced concrete coating over high-quality PLS coating and wrapping specifications.

From unloading the bare pipe to loading of the finished product, all operations are under one supervision . . . *one* responsibility. Uniform quality of Anchorcrete is assured through use of prime materials, careful batching, controlled mixing and thorough curing.

Harvey's ample storage facilities enable you to take delivery of your Anchorcreted pipe when you need it. More than 600 feet of dock space, with traveling crane, provide speedy loading directly onto your barge. This eliminates extra handling; assures delivery of protected pipe in perfect condition.

PLS-Harvey is another example of complete service that is designed to give your steel pipe the finest possible protection at lowest possible cost.

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PIPE LINE SERVICE CORP. — SERVICE — EQUIPMENT — MATERIALS — FRANKLIN PARK - ILL.

Pipe Line Service Corporation

HARVEY, LOUISIANA

A SUBSIDIARY OF AMERICAN STEEL FOUNDRIES

Quality pioneers in coating and wrapping pipe for over a quarter century

For more data on advertised products, use Readers' Service Cards, last page.

B&W WELDING FITTINGS

MADE BY MEN WHO KNOW STEEL

B&W Welding Fittings manufacturing is integrated with the Division's own steel-making and tube-making facilities. Consider the relation between steel-making and the manufacture of welding fittings . . . B&W not only knows the complexities of fittings manufacturing, but also has an intimate knowledge of the making of the steels from which the fittings are formed. Integration plus knowledge naturally makes for a superior product. It enables B&W to provide a completely quality-controlled fitting, matched to end-use service. It also can mean better deliveries of welding fittings made from the specialized steels because B&W can control scheduling from melt to shipment of the finished material.

B&W Welding Fittings and Flanges are available in carbon steel and the B&W CROLOYS in a complete range of types and sizes. Write for B&W Bulletin FB502. The Babcock & Wilcox Company, Tubular Products Division, Welding Fittings Plant, P. O. Box 230, Beaver Falls, Pennsylvania.

B&W

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TUBULAR PRODUCTS DIVISION

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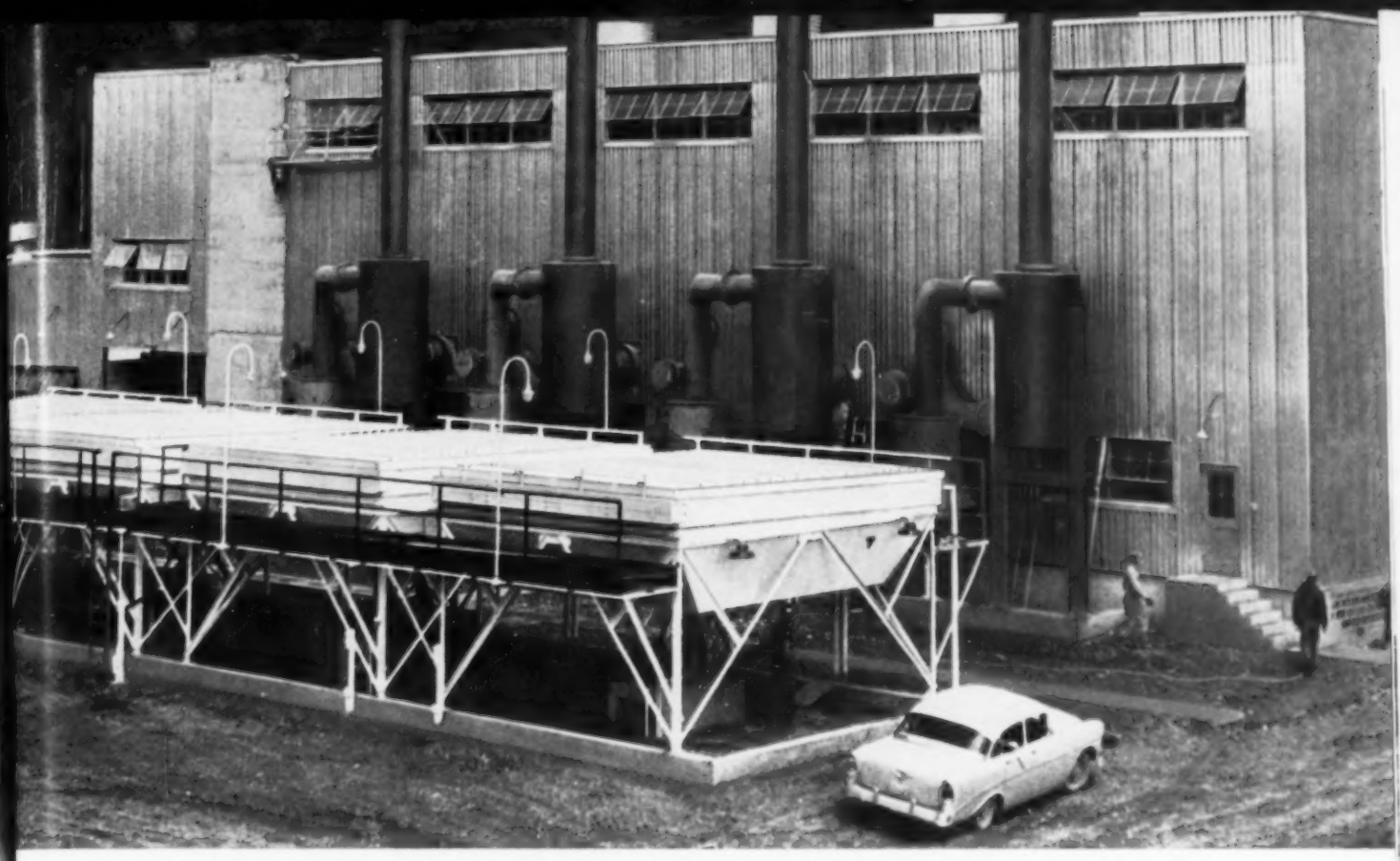
Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals



Twenty air cooled units like this cool engine jacket water for four Canadian "Big Inch" compressor stations. Units are designed to dissipate 8.6 MBTU/hr. from the 288 gpm jacket cooling water at temperatures from 170 to 110° with an ambient temperature of 90° F. General contractor: Canadian Bechtel, Ltd.

Canadian "Big Inch" cools jacket water with Trane Fluid Coolers - at 35° below!

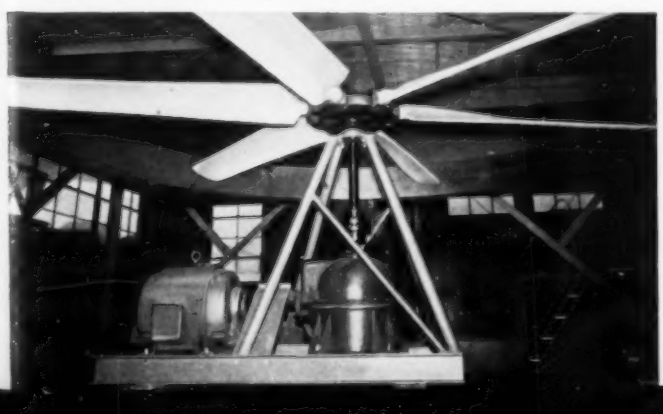
Westcoast Transmission Company's 650 mile-long, 30-inch pipeline system through British Columbia passes through country where winter temperatures are very low. Cooling engine jacket water for compressor stations along the way takes rugged equipment—coolers that can function efficiently at 35 or 40 degrees below zero.

Westcoast Transmission Company chose TRANE Fluid Coolers for this important job. Air cooling was essential at these extreme temperatures. And TRANE Fluid Coolers have shown that they meet exacting requirements under all weather conditions.

More and more major transmission companies are turning to TRANE for rugged, dependable Fluid Coolers. Many of these companies report simplified maintenance, a minimum of adjustment problems. And, with TRANE Fluid Coolers, engineers know that they can depend upon the accuracy and completeness of the capacity ratings—based upon the industry's most complete laboratory testing.

When you have a fluid cooling problem, turn to TRANE! Call your nearby TRANE Sales Office. Or write TRANE, La Crosse, Wisconsin.

The air handling segments have shutters for control of their forced vertical air flow, with variable-pitch propellers. (TRANE Fluid Coolers are also available with horizontal discharge.) 2-speed fan, motor and drive are factory-aligned on a single metal base. All framework parts are predrilled and match-marked.



For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 100 U.S. AND 19 CANADIAN OFFICES

More than 600 miles long, new Four Corners crude pipe line can be operated over its entire length from Los Angeles terminal.

Getting up to 80,000 barrels per day of crude from the prolific oil-producing Four Corners area (where the states of Colorado, Arizona, New Mexico and Utah meet) to the refining centers of Southern California is the job of the new Four Corners Pipe Line.

Providing the vital instrument readings necessary for efficient, economical, remote operation of this pipe line is the task of Bristol Metameter* telemetering, operating over privately-owned microwave radio links.

Four Corners Pipe Line is the first of such a length ever designed for operation from a single, central control station at its Los Angeles terminal.

The telemetering system provides both for transmission of instrument readings to the central dispatcher's office and for local readings at pipe-line stations (see map).

This is just one of hundreds of Bristol telemetering systems in operation today for oil pipe lines, natural gas pipe lines (including corrected flow), electrical transmission networks, water plants, and industrial plants. Pressure, liquid level, flow, temperature, mechanical motion, voltage, current, power, are just a few of the variables that can be transmitted for distances varying from a few yards to hundreds of miles. Almost any transmission medium may be used: Telephone lines, carrier current, microwave, VHF or UHF radio. Find out what Bristol telemetering can do for your operation. Write the Bristol Company, 114 Bristol Road, Waterbury 20, Connecticut.

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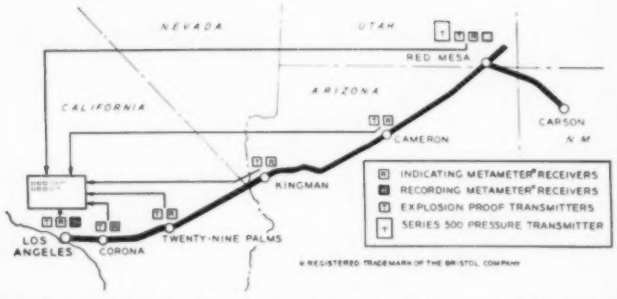
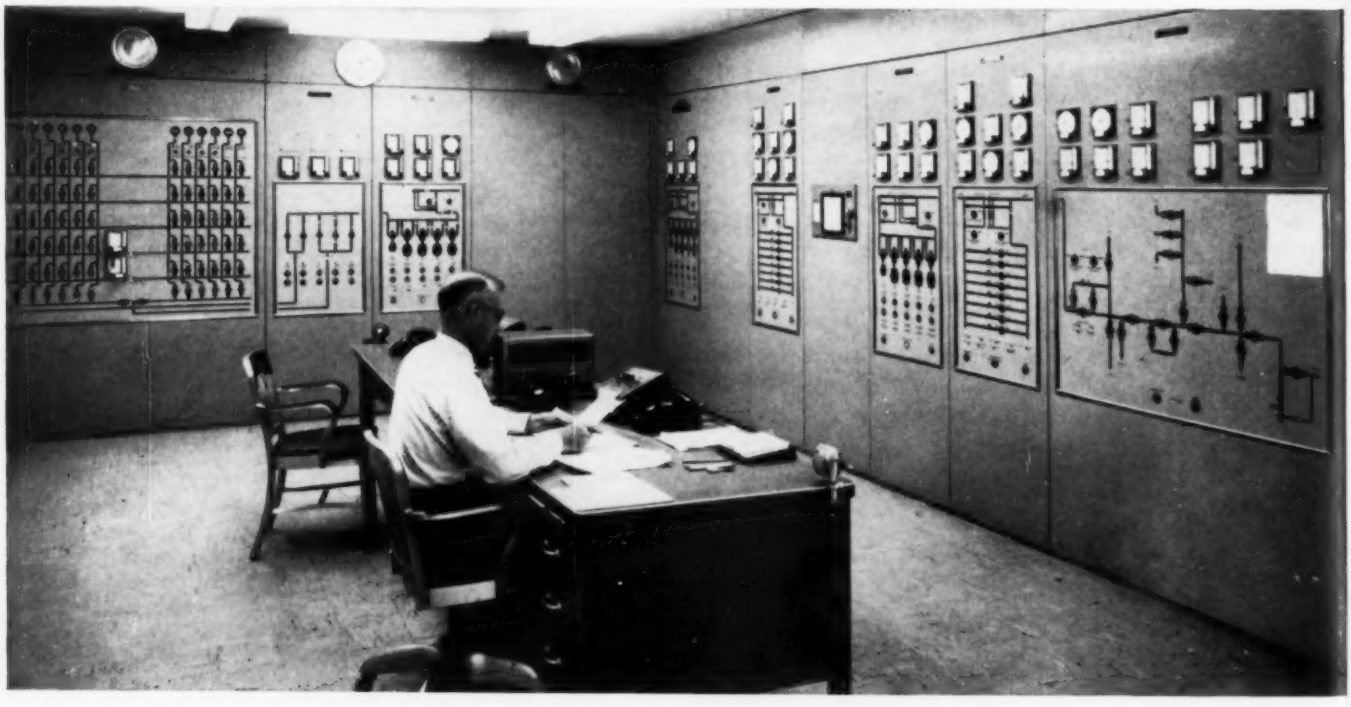
Central supervision from Utah to California with BRISTOL TELEMETERING



Miniature Bristol Telemetering Recording and Indicating Receivers, on panel shown below, give dispatcher instant instrument readings from points up to 600 miles distant along Four Corners Pipe Line. (See map.)



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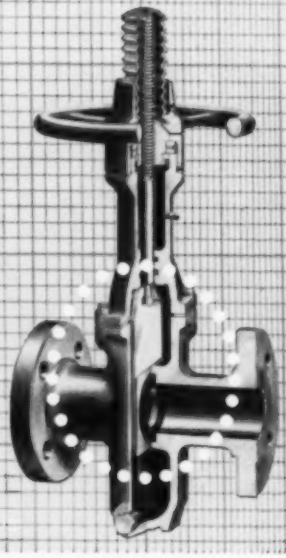

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W-K-M's new Pressure Sealing Gate Valve

Almost without effort . . . you get a tight seal on *both* sides of the line. The secret? A unique seat design that puts line pressure to work *for* you. The greater the pressure, the tighter the seal!

Seats automatically adjust for wear . . . automatically relieve excessive body pressure. And on-the-line overhaul is easy.

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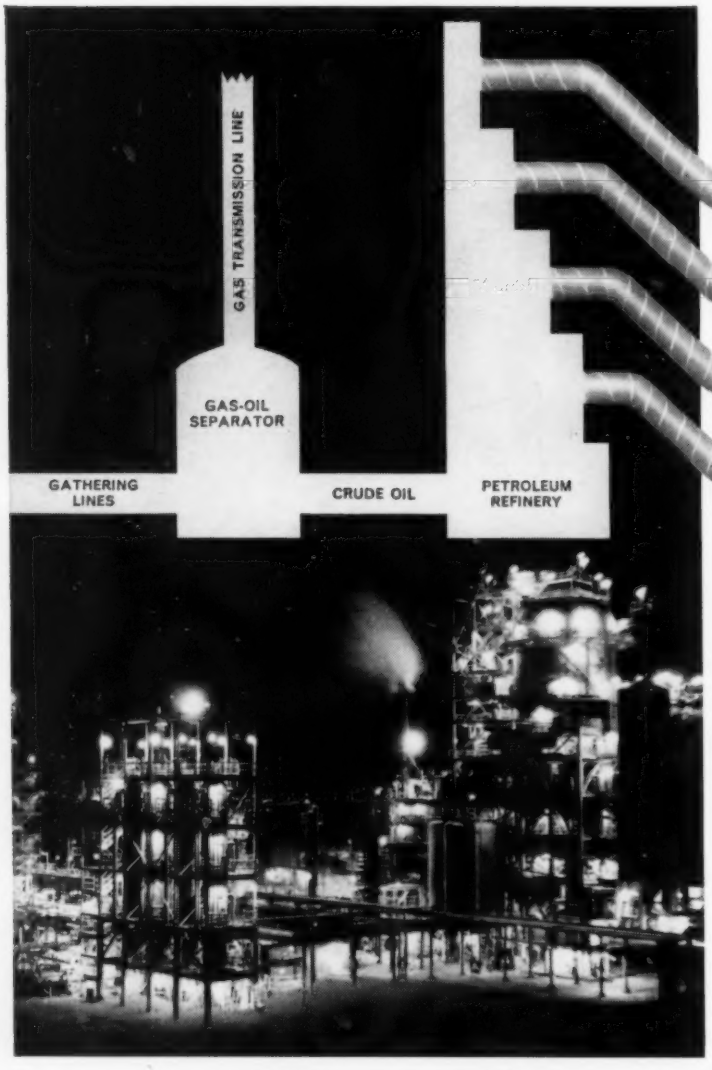

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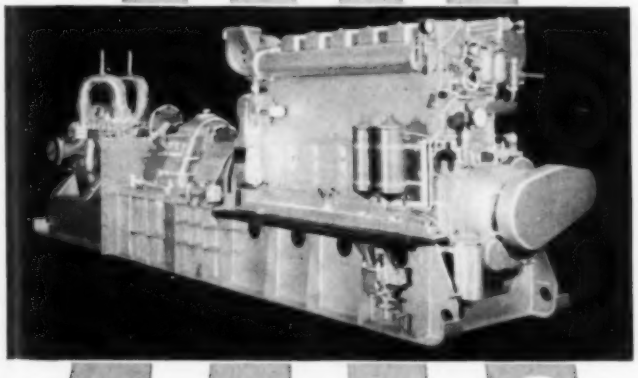

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PIPE LINE PANORAMA

Low-Cost Alarm and Control System Pays Off . . . Humble Oil's recently completed battery-operated multichannel communications system has paved the way for new economy in high speed remote controls. Cost: $2,500 per station (excluding towers).

In operation at Grand Isle, La., offshore unit, radio alarm and control system uses newly available industrial development frequencies in VHF band. Estimated battery life: 3-5 years.

How to Service Utility Lines Along Major Highways . . . Planned access control is the key, according to U.S. Bureau of Public Roads' Joseph Barnett. Close coordination between highway departments and utilities in highway construction—utility adjustment, installation, relocation, and removal is essential. Without it, higher costs may result.

Along same lines, Houston Natural Gas satisfied engineers directing Texas' interstate highway program by using shop-made sheepsfoot rollers to compact backfill. Rollers required less labor, less equipment than most other methods—and produced better results.

First Remotely Supervised Automatic Compressor Station for Gas Transmission . . . Colorado Interstate's gas dispatcher can now telemeter over microwave channels the discharge pressure figure, or set point control as it is known, to compressor station set point controller. This resets set point of discharge pressure controller at desired level.

Changes in discharge and suction pressures, and number of engines on line are visible on station monitor. This information also is typed out on electronically controlled typewriter in control center. Plans are to use this type of control at new stations to be built in $91 million expansion program now awaiting FPC approval.

Will Pembina's Canada-U.S. Line Start Construction Next Year? . . . If it does, Great Lakes area chemical plants will have access to huge supply of hydrocarbons and sulfur from western Canada's gas wells.

Project: First, a 900-mile pipe line network to provide 20 wet-gas processing plants in Alberta foothills region with about 92,000 barrels of propanes, butanes and condensates per day—3 million long-tons of sulfur per year. Second, a 1,300-mile, 14-inch line to transport products to separation plant near Chicago.

Pembina still is uncertain how it will ship sulfur. Alternatives: water slurry, as SO_2, H_2S, or sulfuric acid.

Status: Financial backing, green light from Canadian and U.S. governments, potential customers, are now being sought. Also, Pembina has formed U.S. subsidiary, Dakota-Eastern Pipe Line, Ltd., to handle U.S. end of project. Hopes are to start construction next year.

Pipe Line Briefs . . . In recent report, Laborer's International Union announced total income of $5 million during '59, while expenses totaled $4.5 million. On December 31, Union had $700,000 in cash funds, $15 million in government securities and bonds . . . **Oren T. Harris, Chairman of House Investigating Committee,** says Midwestern investigation points up "serious inadequacies in FPC laws and procedures"—and indicates that changes in Natural Gas Act will be pushed next year to deal with ex parte contacts.

Helicopter hovers over pipe rack as pipeliners hook slings to 40-foot joints of 24-inch pipe.

After 3,200-pound load of pipe is "hooked", signal is given to mechanic in craft's lower cabin. Pilot usually cannot see joint, but word from mechanic tells him he is ready for lift.

Helicopter Speeds Stringing on Trunkline's Marsh Work

By Donald G. DePugh
Construction Editor

WHEN MARSH MUD coupled with a lack of access roads made it virtually impossible to string pipe on a short section of Trunkline Gas Company's right of way near Kountze, Texas, contractors overcame this obstacle with helicopters.

Sharman, Allen, Gay & Taylor, Inc., and stringing contractor, J. O. (Red) Willett Pipe Line Stringing Corp., subbed out stringing to Petroleum Helicopters, Inc., on 2.3 miles of 24-inch pipe. And the whirlybirds paid off—making it possible to complete the job several days earlier and leaving a "workable" right of way for the pipe gang. Another dividend was the helicopter method cut stringing costs on this particular marsh job.

Estimates for conventional stringing under similar conditions in South Texas and Louisiana run from 75 cents to $1 per foot. The helicopter did the job for about 41 to 75 cents per foot depending on the distance pipe had to be carried in flight. The job took less than 25 hours over a four-day span.

Main point stressed by Sharman, Allen, Gay & Taylor was that Athey wagons and other heavy equipment would have given the right of way a terrific beating.

Helicopter Stringing Procedure. Two pilots and two mechanics alternated one-hour shifts in air-lifting the large diameter pipe. With a mechanic in the lower cabin to coordinate lifting and lowering signals between pilot and pipe handlers below, the helicopter hovered over stacked pipe. Handlers hooked pipe with the 30-foot long sling harness and signaled to mechanic to hoist the joint. The helicopter then lifted pipe and carried it to the right of way traveling at about 60 mph.

On this particular job, the craft had to fly over trees to get to the right of way. In many instances this made it difficult to spot the exact location for pipe placement and thus enable the helicopter to make a good approach to the right of way. Red-

Up, clear and away as joint starts on its way. 'Copter travels about 60 mph with load, 100 mph on return.

Flagman (lower left) guides helicopter to exact spot on right of way. As the 'copter descends, pipeliners wade in to unhook joint. Production once reached peak rate of 21 joints an hour.

flag markers were positioned by one of the ground stringing crewmen at measured 40-foot intervals. In this way the pilots were given a "target" for making their approach and speeding the job. Two pipe handlers unhooked each joint from the helicopter on the right of way, again signaled to the mechanic when all was clear and the 'copter returned, at 100 mph, to the pipe rack for another joint.

Pipe skids stayed in the joints during flight. Total weight per joint was 3,200 pounds.

Rate of Stringing—Cost. Stringing efficiency improved as the job progressed and maximum production for the helicopter was 21 joints in one peak hour.

In stringing with a helicopter, even more so than by conventional methods, cost depends upon speed. Air-lift speed depends on three things: flight distance, navigation ease, and pipe hookup and release time. Flight distance is by far the greatest factor. Efficiency of the helicopter is increased in direct proportion to reduction of the distance between pipe rack and drop point. With pipe stacked three miles from the right of way, it took Petroleum Helicopters' pilots three minutes to reach their destination on each run.

Natural hazards, such as tall timber, can cause navigation trouble. On the Trunkline spread, the right of way was narrow—80 to 100 feet—and bordered by high trees. In such a narrow fairway, helicopters were not able to turn around so they had to lay joints of pipe perpendicular to the line path. Helicopters normally flew at about 300 feet.

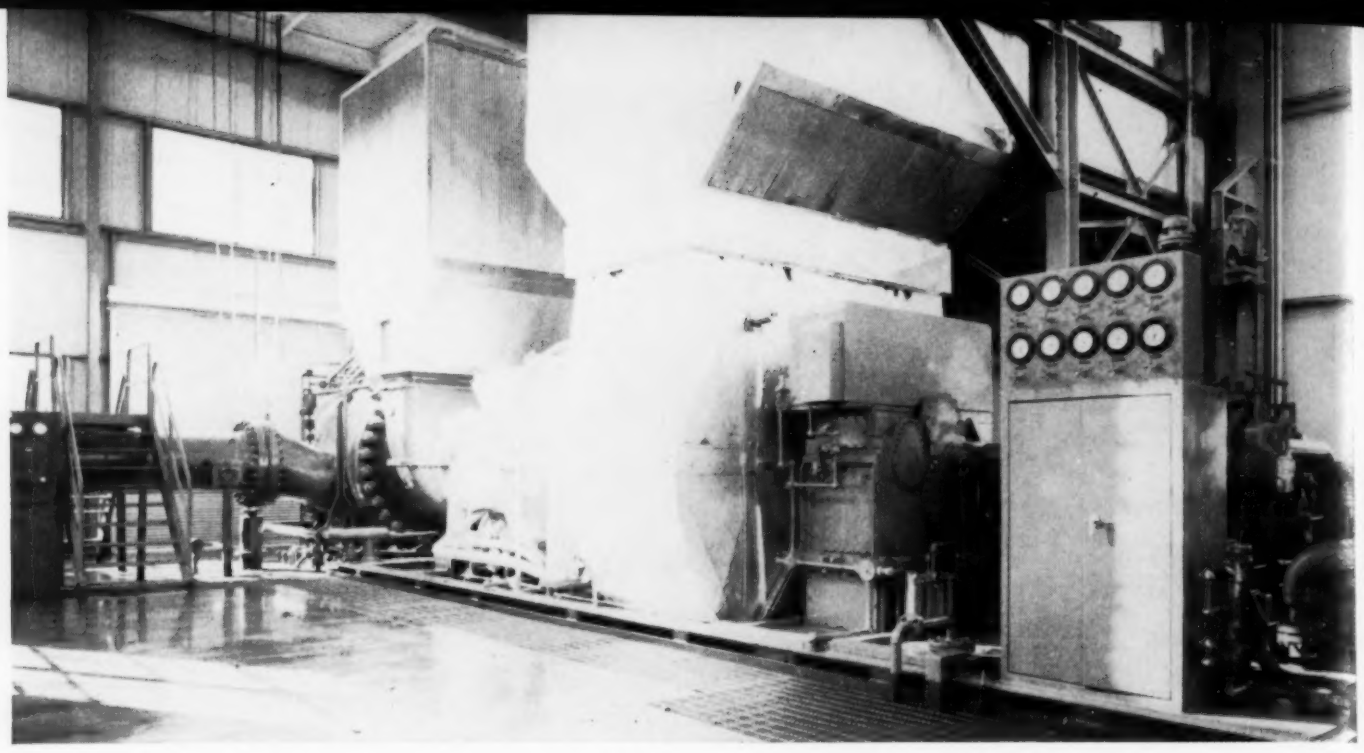
The third main factor affecting stringing costs was pipe handling. As handlers became more proficient in hooking and releasing joints, stringing rates improved considerably.

Experience Boosted Efficiency. Production figures improved daily as the distance was shortened and pipe handling improved. Only 50 joints were strung in about 5 hours on the first day of work. As crews gained experience, the helicopter increased work rate to 121 joints in 8½ hours by the third day. Cost per foot ranged from 41 cents to 75 cents and averaged about 65 cents for the entire job. A representative cost of helicopter leased to contractors is $300 per hour.

Helicopters Safety Feature. The entire unit below the helicopter—cables, spreader bar and pipe—can be dropped by the pilot if necessary and clear below. An electric switch would release cable from helicopter. The single-rotor helicopter used in stringing on this Trunkline job has a 57-foot rotor blade; it is capable of lifting a 4,000-pound load.

On other work earlier this year, helicopters were used to string 17 joints of 24-inch pipe for Transcontinental Gas Pipe Line Corporation near Kaplan, La. Several companies have used helicopters for pipe line surveys, inspection, supervising construction, right-of-way maintenance and transporting personnel and small equipment items to remote locations.

—The End



General view of one of the large unattended gas-fired turbine stations where the fire-resistant synthetic lubricant reduces the fire hazard. For the most part, the danger of fire would come in event of equipment failure, which often is accompanied by a spray of oil. Fire-resistant features of the new lube oil remove this danger.

PART 1

Synthetic Lube Reduces Fire Hazard at Turbine Stations

How fire-resistant lubricants were developed and what they will do

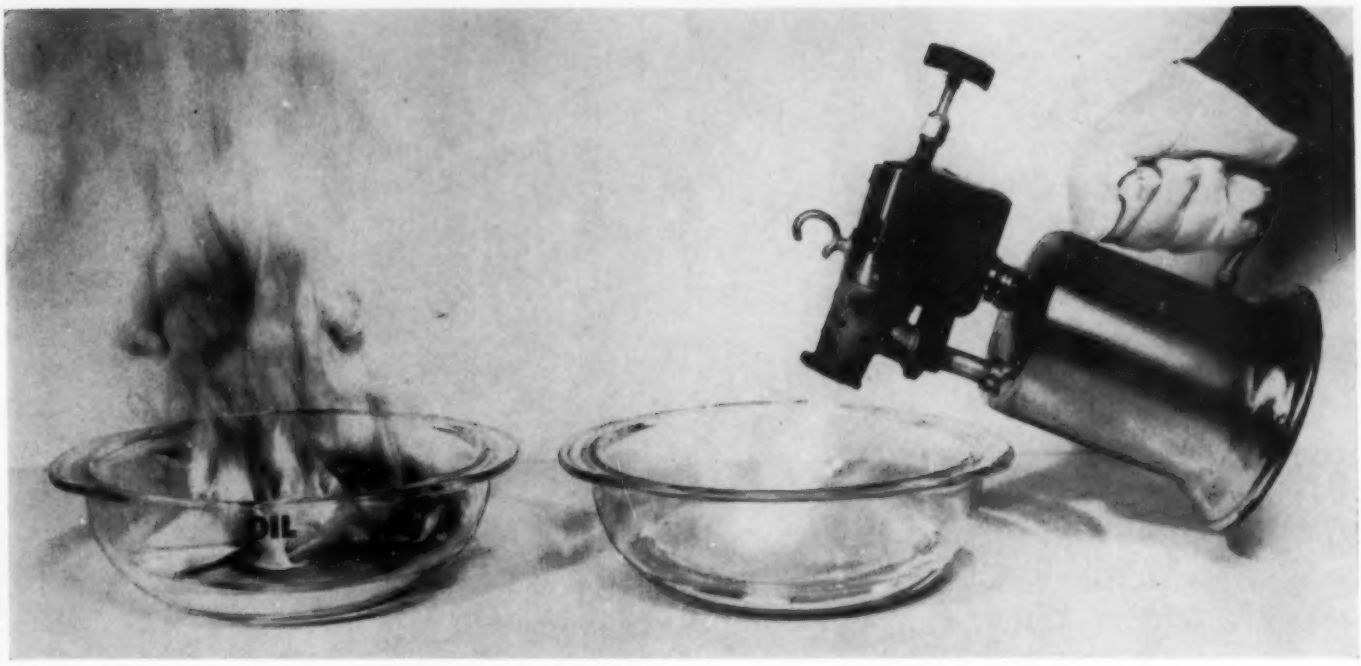
By O. M. Fletcher, Assistant Supervisor
of Design and Construction
Texas Eastern Transmission Corp., Shreveport, La.

WITH 136,000 GAS TURBINE horsepower in operation prior to the use of any fire resistant oil, the Gas Division of Texas Eastern Transmission Corporation became well acquainted with the potential hazards inherent in using petroleum lubricating oils which can burn in high speed, high temperature gas turbine installations. In two such instances potentially disastrous lube oil fires were prevented only by alert operators who happened to be in the right place at exactly the right time. Turbine failure in still another instance ultimately caused a fire, resulting in a complete station outage. A load compressor failure, in yet another instance, was responsible for a lube oil fire. The lube oil fire, in this case, was of short duration, actually about one hour. However, the oil fire damage was far more critical to the station operation than the compressor failure.

The Double Hazard. Centrifugal pipe line compressors require high-pressure seal oil systems with considerable external piping and controls. Most gas companies operating such compressors are well acquainted with the results that may follow minor control and piping failure. In reviewing situations such as these, it becomes painfully evident that all oil pumps must be shut down immediately when an emergency arises to avoid feeding a possible oil fire. But this brings up the possibility that all bearings could be wiped, causing subsequent machine damage. **In other words a machine's expensive internals are risked each time an emergency shutdown occurs.**

This is the situation that caused Texas Eastern to consider the protection afforded through the use of the synthetic fire-resistant lube oils.

What Was Needed. The decision to switch to fire-resistant synthetic lubrication came at a time when Texas Eastern was in the process of adding 114,000 additional gas turbine horsepower to the conventional ones in operation. Some 53,000 of this added horsepower was to be installed in four isolated, remotely controlled and unattended stations. Obviously, in these stations there would be no operator to be in the right place at the right time, should a major emergency occur. Further, these stations were being located in isolated areas, where there would be no municipal fire department to assist with a major fire. This type installation would therefore be most vul-



Flame fails to ignite synthetic fire-resistant oil. Note the water-like clarity of the synthetic. At left, the lube oil continues to burn.

nerable to the potential hazards of lube oil fires. The obvious answer—a fire-resistant lubricant.

Development of Fire-Resistant Lubricants. Numerous articles have been published covering years of development and lab testing of fire-resistant fluids. Yet, no fire-resistant fluid had ever been applied to a major turbine, gas or steam until Texas Eastern initiated it. Such an application represented a large step into the untried and unknown. At the time however, all available data indicated that fire-resistant lubes were available which would satisfactorily perform the necessary lubricating functions.

Fire-resistant turbine lubricants seem to have come about mainly through an evolution process, the starting point being fire-resistant hydraulic fluids. As air compressor fouling and resulting fires were also a problem, these fire-resistant hydraulic fluids were redesigned into compressor lubes. With progress and acceptance of the hydraulic and compressor applications, the fluid manufacturers turned next to the steam turbine lubrication field as one representing a great potential demand.

What Are the Lubricants? At the present stage of development, fire-resistant lubricants offered for turbine application can be separated on the basis of formulation into five general groups:

1. Pure Phosphate Esters
2. Phosphate Ester Based
3. Halogenated Mixtures
4. Water and Glycol Mixtures
5. Water and Oil Emulsions

Of these five, the **pure esters** and the **ester based** groups have shown most promise on paper and in lab tests; as a result, very nearly all the small scale field tests have been limited to these two. Both seem to meet the requirements of a turbine lube and as such are the ones most widely offered for this type of application. This discussion is therefore limited to these two groups. Both are offered as standard commercial products in a wide range of viscosities of 60 SSU to 1,000 SSU at 100° F. These oils are much heavier than petroleum oils having specific gravities ranging from 1.15 to 1.40 at 60/60° F. The ester based is the heavier of the two.

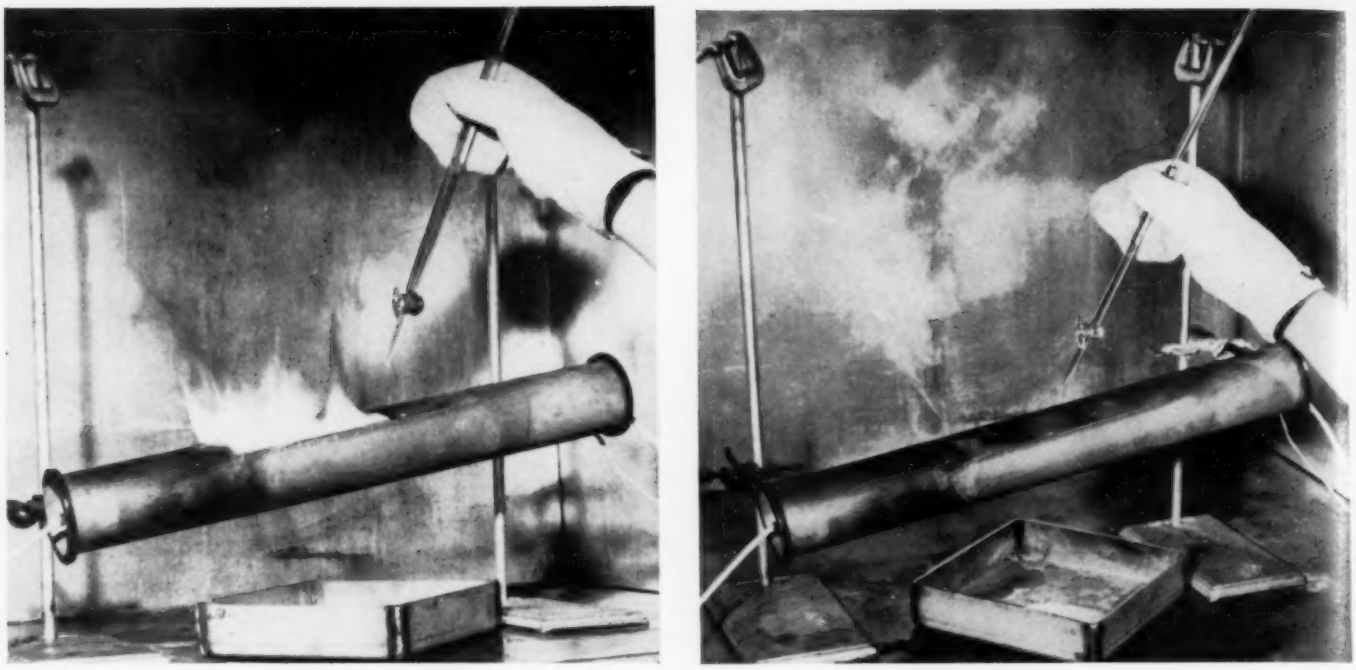
Under ASTM tests, flash points fall between 430° and 465° F with fire points of 665° to 685° F. Autogenous ignition points (ASTM D 286-30) for both are well above 1,100° F.

Neutralization values are noted to be from .01 to .15 mg KOH/gr. Data reflects the pour points to fall between —30° to 30° F.

Various tests, ASTM and otherwise, have been devised to determine the fire resistance of the synthetics. Among these tests are the following which adequately established fire resistance of both pure ester and ester base fluids.

TABLE 1—Flammability Data

TEST	RESULTS
Autogenous Ignition Temperature (ASTM Method D: 286-30)	Greater than 1,100° F.
Molten Metal Ignition Temperature OS-81 was sprayed, dripped and flooded onto the surface of a molten alloy at approximately 1,500° F.	Fluid did not flash or ignite.
High-Pressure Ignition Test The mist from spraying OS-81 through a small orifice under 1,000 psi was subjected to the flame of an oxyacetylene welding torch.	Even when exposed to the hottest portion of the oxyacetylene flame (approximately 6,000° F.) the fluid did not flash or ignite.
Hot Manifold Test OS-81 was dripped onto the surface of a hot manifold.	Did not burn at 1,300° F, nor when the surface temperature was increased to 1,475° F, the limit of the equipment.
Arc Ignition Test OS-81 was sprayed through a ⅛" petcock at varying pressures up to 200 psi through a carbon arc that had a free arcing distance of approximately 1½".	At no time was a flash observed, nor did the fluid burn.
Static Carbon Arc Test A metal pan was filled to a fluid depth of approximately ¾" and the arc struck between the electrode and the bottom of the pan, passing through the fluid. The arc was sustained for approximately 30 seconds during which time the carbon electrode became white hot.	No flash was observed, nor did the fluid burn.



HOT MANIFOLD TEST. Synthetic fails to ignite when dripped on 1300° F manifold (right), but ordinary lube oil (left) ignites readily.

Laboratory testing for lubricity, wear, shear stability, etc., has been determined by the Shell Four Ball Wear Test, the Timken E. P. Test, Angular Contact Ball Bearing Test and the Vane Pump Test for Wear Protection and Shear Stability. The remaining area of fluid testing in the lab has been concerned with general stability of the liquids, foaming oxidation-corrosion and general compatibility of the fluids with other materials. In general, test work establishes that ester base and pure ester fire-resistant fluids more nearly match the desired qualities of a top grade petroleum turbine lubricant while having the necessary feature of fire resistance.

As previously mentioned, field test application by users has been almost entirely devoted to the pure ester and ester base oils in small steam turbine units. These user tests have been conducted by three major electric utilities in steam turbine-generator and steam turbine-boiler feed pump installations of no more than 1,500 horsepower. According to data reported to the Technical Committee C, ASTM D-2, (Study Group on Fire-Resistant Turbine Fluids), one utility utilized both ester base material and a halogenated aromatic containing other hydrocarbons and additives. A second applied only the ester base fluids. The test results as reported could lead to no conclusions because of short duration testing along with either malfunction in lubricating systems or foaming of the fluids themselves. The third utility had applied ester base oils in two units, one covered a three year continuous test, the other a year continuous test. In both tests basically satisfactory service was obtained.

All five groups of the fire-resistant fluids pose some problem in application because of incompatibility with some types of materials normally used in gaskets, packings, paints, etc. Both the pure ester and ester base oils are generally similar so far as material compatibility is concerned. The natural rubbers, Buna N and Neoprene are generally unsuitable and should be replaced with other compatible materials such as butyl, viton A, nylon, silicone, poly FBA, Teflon, etc. These are materials of the elastomers group.

Despite the current higher synthetic oil cost, consumption experience on these particular turbine applications has shown a lower oil consumption cost/horsepower than many of the petroleum oil using turbines on this system.

Selection of a Specific Fire-Resistant Lube Oil. In evaluating the various fluids for this specific application, the following items became the major items for consideration:

1. Viscosity
2. Fire-Resistance
3. Lubricity (Lab Wear Test Data)
4. Field Performance Tests
5. Oxidation Resistance

As regards viscosity, it was deemed essential that the absolute viscosity of the fluid should match that of 150 SSU @ 100° F petroleum turbine oil, at the maximum operating condition of 180° F. Further, the viscosity curve should closely approximate the petroleum oil curve down to the low operating temperature of 110° F. Also, the oil selected had to show comparable viscosity stability after having been in severe service.

So far as fire resistance and lubricity were concerned, it was apparent that both the esters and ester base lubricants were satisfactory.

The field performance tests were felt to be a very important factor in selecting a fire-resistant fluid for such unattended installations. Such user or consumer tests seemed to indicate that ester base liquids had an edge in trouble-free performance. Foaming characteristics had been an ever present problem throughout development and

ATMOSPHERIC FLAME EXPOSURE TEST. Note that the synthetic oil will propagate flame when exposed to 6000° F oxyacetylene flame (above), but ordinary lube oil (below), ignites and sustains combustion.

early field testing; therefore, this characteristic was closely considered when evaluating the field performance tests.

Oxidation resistance of a fire-resistant fluid becomes extremely important when considering the reluctance of turbine manufacturers to use unpainted oil reservoirs. The bare steel reservoir is a necessity with most fire-resistant fluids as there are no paints available commercially which are guaranteed to adhere to steel when constantly exposed to these fluids. The ASTM oxidation test, it was felt, would give the best clue to what could be expected to take place in an unpainted oil reservoir. Lab facilities determined that some of the ester base liquids could easily pass the required 1,000-hour ASTM oxidation test required of premium petroleum turbine oil. One specific liquid was on specification after 7,000 hours.

In addition to the testing necessary to determine satisfactory performance of a fire-resistant lube as a lubricant, these synthetics also must perform well as a seal oil. This called for additional testing to ascertain solubility characteristics of the oils when exposed to 1,000 psi methane. Both esters reacted favorably in these tests.

Texas Eastern ultimately decided on a fire-resistant fluid known as Type OS-81 for application in the four selected gas turbine stations. The basic qualities of this liquid are as follows:

Specification	Range	Typical
Viscosity @ 100°	150.2 — 168.2 SSU	156.2 SSU
@ 210°	36.3 — 36.9 SSU	36.5 SSU
Specific Gravity @ 77/77° F	1.390 — 1.410	1.403
Neut. No. mg KOH/gr.	0.10 max.	0.07
Pour Point	+ 20° F max.	+ 15° F
Specific Heat @ 77° F Btu/lb/°F		0.31

General Description of Converted Stations. Stations with the greatest need for the protection afforded by a fire-resistant lube were, as mentioned, the four new installations on Texas Eastern's Penn-Jersey line. (See Pipe Line Industry, May 1959, page 26.) These new stations are intermediates, being located between existing three-unit manned gas turbine stations. Each new station is designed for unattended operations, being remotely controlled from the adjacent downstream manned station. These installations are self sustaining with the basic sta-

tion component, a single unit gas turbine, driving a centrifugal load compressor.

A simple cycle (non-regenerative), single shaft, two stage gas turbine makes up the power unit which is rated at 13,400 hp @ 80° F., operating at 4,860 rpm. The inlet temperature on the first stage rotor is 1,450° F with an exhaust temperature rating of 800° F. At rated conditions, the turbine axial flow air compressor handles 568,000 pounds of air per hour through 16 stages of compression. The turbine unit proper, with accessory gear, starting turbine, turning gear, lube oil pumps, etc., is on an integral fabricated structural steel base. Within the structural base of the turbine is the fabricated lube oil reservoir.

The turbine rotating element is supported on two elliptical journal bearings with a double thrust arrangement with a taper-land thrust bearing. Bearing oil control is by means of the usual oil shields and labyrinth seals. Ambient air flow through the labyrinth seals is maintained by a vapor extractor on the reservoir.

Coupled to the turbine unit is a two stage 30-inch by 30-inch pipe line booster compressor which, at rated conditions, handles 730 MMscfd of natural gas at a suction pressure of 637 psi, discharging at 969 psi. A single shaft rotating element again is supported by two journal bearings and a double thrust bearing system. Sealing of the rotating element is by a combination of floating "L" rings and labyrinth oil seals.

Both turbine and load compressor are served by one common lube oil system built around the 2,000-gallon turbine reservoir. This reservoir, as previously mentioned, is kept under a vacuum of 1.5 inches of water by a vapor extractor. Taking suction from the reservoir, is an accessory gear driven, vertical, gear type, main lube oil pump. The auxiliary lube oil pump is an a.c. motor driven, vertical, centrifugal. Both pumps are rated at about 200 gpm. A d.c. motor driven, vertical, centrifugal pump of 120-gpm capacity provides emergency oil service.

Both the main and auxiliary pumps discharge at 50 psi through a shell and tube oil cooler and then through a series filter system consisting of magnetic, a knife edge, and a full flow, all being standard type filters. Oil leaves the filters by means of a header which traverses the oil reservoir on the way to the bearings. The emergency d.c. pump, when operating, bypasses both the oil cooler and filter system discharging directly into the bearing supply header. Before any oil is delivered to bearings, the header supply pressure is dropped and regulated to 25 psi. All bearing and coupling drain oil is dumped directly into the reservoir.

The load compressor bearings and seal oil system receive a supply of 50 gpm, 25 psi oil from the turbine lube oil header. Compressor bearings and seal oil drains, like turbine bearings, dump into the reservoir.

The load compressor seal oil system is made up of a 40-gpm positive displacement pump taking suction from the turbine lube oil header and discharging through a small filter bank to the seal oil control system. At about 1,000 psi the seal oil is delivered to the compressor seals and the emergency seal tank. Seal oil from the compressor is put through a separator-accumulator before being returned to the reservoir.

Low pressure control oil at 50 psi is taken from the main lube oil header ahead of the system filters and put through a small bank of micronic type filters before being fed to the control oil system. High-pressure control oil at 300 psi is supplied by a small shaft driven gear pump taking suction from the 25 psi main lube oil header.

An external 3,000-gallon tank serves as oil storage. Make-up from storage is accomplished by the combination of a small motor driven gear pump and 50 psi air. Oil is moved from the storage tank through a filter, metered and fed to the reservoir.

Oil cooling, as mentioned, is accomplished by means of a shell and tube heat exchanger, the water side of which uses a water-glycol combination. This circulating water system is composed of two motor-driven centrifugal pumps, a small surge tank and two bays of water to air exchangers. Temperature regulation is by means of a bypass control valve around the heat exchanger and by control of the atmospheric cooler.

Basically, the oil system operates around a normal bearing oil supply temperature of 110° to 130° F and bearing drain temperature of 175° F.

Engineering Approach to Fire-Resistant Lubricant Conversion. Actual station construction had begun just prior to the selection of a specific lubricant and all turbine and compressor units were in various stages of manufacture as petroleum lube oil machines. This time element, among other considerations, made the turbine manufacturer somewhat less than enthusiastic over this major untried step. He was required to make the following studies:

- Examine and analyze theoretical design data so as to make the turbine suitable for satisfactory operation with OS-81 fluid. This analysis, at all operating conditions, would cover the lube and control oil systems in detail, specifically such items as bearings, gears, couplings, pumps, filters, piping, valves, regulators, control mechanisms, etc. Such parts requiring replacement were to be furnished for field installation.
- Special study would be devoted to the indicated dual problem of internal non-compatible reservoir coatings and probable bare steel reservoir operation.

Test operation on the synthetic oil was highly desirable; however, the manufacturer declined to conduct such testing, because of possible delays in the shipment of the equipment.

As for the gas load compressors, a similar examination and analysis program was worked out. A basic advantage was to be gained by testing of compressors on the synthetic lubricant.

To quickly resolve problems, close liaison was maintained between manufacturers and research groups. One of the most notable problems was the removal of rust inhibitor coatings from reservoir tanks. Another concerned tachometer generator windings incompatibility. A third, more minor, stemmed from a lack of data on pressure drops through filters handling the synthetic.

The turbine examination and analysis revealed that the following basic items would perform satisfactorily without modification:

1. All main and auxiliary unit bearings
2. All gearing
3. All couplings
4. All pump motors and insulation

5. All filter elements, except for certain seals and gaskets
6. All piping, main, control and otherwise, except for minor items.

Items requiring change or modification are shown in condensed form below:

1. Replace regular Permatex No. 2 with Permatex 1281 on all lube oil joints. Apply Crane plastic lead seal No. 2 to all threaded joints. It was realized that some corrective measures would be overlooked; therefore, testing was done to determine if reasonable portions of uncompatible materials could be handled by the fire-resistant lube.
2. Replace all lube oil piping gaskets with Vellumoid D-10E2.
3. Replace various gaskets, seals, "O" rings, sealing compounds, etc., in control and accessory devices with Vellumoid D-10E2, butyl, silicone, and teflon materials.
4. Reduce auxiliary and emergency lube oil pump impeller diameters to suit head requirements on the heavier liquid. Further replace Buna N pump seals with silicone seals.
5. Replace filter gaskets with Vellumoid D-10E2. Also replace "O" rings of magnetic filter with silicone "O" rings.
6. Install a duplex 25 micron filter with associated piping in low pressure control oil system.
7. Replace with Teflon all bar stock valve packings.
8. Replace neoprene packing with silicone material in coupling guard arrangement.
9. Modify tachometer generator by replacing neoprene —lead bushings with butyl or silicone material and by retreating the stator with an epoxy resin varnish.
10. Remove all possible rust inhibitor paint coatings from the interior of oil tanks.

This last item involved considerable lab test effort before being resolved. The rust inhibitor coatings, while excellent for petroleum service, are quickly attacked by the esters which dissolved the paint vehicle releasing the aluminum pigment in sheets or flakes. Tests indicated that an amount of coating vehicle equal to or greater than that used in the coatings could safely be absorbed by the reservoir quantity of OS-81. Normal filter elements, it was found, would efficiently remove pigment particles from the oil stream; however, to prevent filter clogging, all possible coating would be stripped from internals. Factory shotblast cleaning, as proposed for the last two units, could not be accomplished on the first two units; therefore, reservoirs of both units would be field stripped with major components in place. Lab work pointed to methylene chloride and a product "Ferrostrip" as the two best field stripping agents. Naturally, considered in selecting a stripper was the possibility of oil contamination by stripping residue.

Compressor unit examination and analysis likewise reflected that major components would operate satisfactorily. The compatibility examination disclosed that, except for items listed here, all normally used components and materials were satisfactory.

About the Author

Oliver M. Fletcher is assistant supervisor of design and construction for Texas Eastern's Gas Division. Previous jobs with Texas Eastern: head of the Gas Turbine Section and a general engineer in the Engineering Department. Before becoming a pipeliner, Fletcher was a branch manager of Weaks Supply Company of Monroe, La.; a project designer on steam plant facilities for Commonwealth and Southern Corporation and chief draftsman for Alabama Dry Dock and Shipbuilding Company. Fletcher served several years with the FBI and during World War II was in the U.S. Army. He received his B.S. degree in mechanican engineering from Auburn University in 1939.

1. Diaphram protectors required on a control valve.
2. Double the number of seal oil filters to provide a lower pressure drop across filters. This procedure developed from lack of reliable data on filter operation with OS-81.
3. Replacement of filter gaskets with Vellumoid D-10E2 material.

Mechanical testing with OS-81 of all units by the compressor manufacturer gave assurance that large units would operate normally on the synthetic oil. Two compressors were run comparatively on 10W petroleum turbine oil and OS-81. Test data indicated that main journal bearings operated about 4° F higher on the synthetic. Unloaded thrust bearing likewise were about 6° F. higher with OS-81. Of significance were indications that machine vibration readings were about 15 percent lower when using OS-81.

Of equal importance with analysis of the turbine and compressor, was re-evaluation of the station oil system. As designed for petroleum oil operation, oil heat exchange was to be by means of oil to air exchangers. Further, each station's oil storage was in the form of an above ground 3,000-gallon tank. This presented station problems, due to the viscosity index of the OS-81; those related to oil cooling and to cold weather operation at zero or lower required special consideration.

It was apparent that the operating oil system would have to be contained within station building where reservoir and building temperature was maintained at 70 degrees. Consequently it was necessary to use an oil to water exchanger with a transfer loop in the building. The original oil to atmospheric, coolers were found adequate when operating as water to air exchangers. A new water exchange loop was completed by adding a small circulating pump, a surge tank and controls.

Considering the oil pour point of plus 15° F, it was necessary to insulate the outside storage tank and related oil piping. An immersion heater in conjunction with a small circulating transfer pump and a circulating loop to the building, would maintain storage system oil in pumping condition.

Thus, with completion of the station analysis, the scope of conversion work was established.

Part 2 will appear in July PIPE LINE INDUSTRY.

Early model of Houston Natural's sheepsfoot backfill compactor in action. New models have improved pulling linkage; roller can be pulled in either direction without removal from ditch. Operation of the rollers has been very successful and results have been enthusiastically accepted by Highway Department engineers.

Low Cost Way to Compact Highway Crossing Backfill

Sheepsfoot rollers that ride down in the ditch satisfy all engineering requirements of Highway Department and reduce the cost to one-sixth of other compaction methods

By W. C. Dahlman, Chief Engineer
Houston Natural Gas Corporation, Houston

SHOPMADE SHEEPSFOOT rollers that ride down in the ditch have solved a vexing problem for Houston Natural Gas Corp. pipeliners. In the past, the company has had to rely on tamping, tromping and wetting to compact the backfill in ditches over which highways and roads were to be constructed. None of these methods were very satisfactory, yet they were quite expensive.

Take a look at the problem of compacting pipe line backfill and you will see it's not easy to solve. Packing backfill around the bottom contour of the pipe to achieve some semblance of healing is difficult. Moreover, any settlement that comes after the surface structure has been completed could conceivably lead to embarrassing results.

The great Interstate Highway program which was introduced into the area served by our transmission and distribution systems brought rigid requirements for compacting backfill in trenches that crossed and paralleled the highway routes. Achieving satisfactory compactness through tamping, tromping or wetting proved expensive and time consuming. Houston Natural pipeliners started casting about for a more economical method and the tandem, shop-made sheepsfoot rollers shown here provided the answer.

Background. When the highway and road improvement program moved into high gear it had already placed a strain on our manpower and equipment—a condition which will likely be accelerated in the years to come. The actual construction required a much greater amount of work and time than our normal complement of men, material and equipment were prepared for.

Until various highway department inspectors rejected our compaction methods and the resultant optimum moisture content, we were not deeply concerned about the compaction of trenches. It became obvious that the company would be required to spend many thousands of dollars if conventional compaction methods were to be used to meet specifications.

Members of our Operating and Engineering departments discussed the problem and, as could be expected where there is a spirit of teamwork, a solution was forthcoming. The "ditch-walking" sheepsfoot roller was conceived.

The accompanying illustrations show the models which are the result of considerable experimental work in our shops. As on-the-job tests were carried out, many changes were made from the original model. Field use eliminated and changed some of the basic design and pointed out defects which were corrected. Each subsequent model was an improvement, and, although we realize that the present model is not perfect, it is certainly adequate.

There are, of course, limitations to its performance, but these are more than offset by the performance rec-

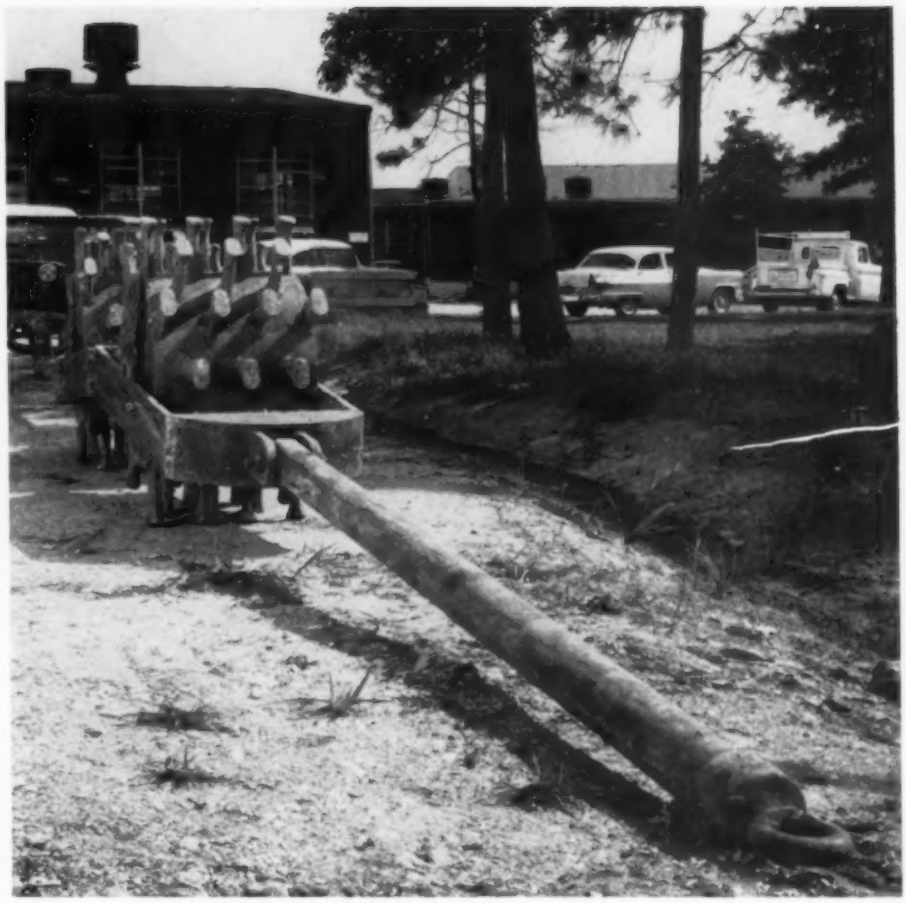
ords to date. Telephone poles, culverts, buildings and other pipe line crossings offer obstacles. In these circumstances, the air-tamp, hand tamp and even hydro-tamp methods have been employed, either in conjunction with the sheepsfoot roller or alone, depending, of course, on conditions. It has been our good fortune that the sheepsfoot has been the method which has been employed to backfill the vast majority of those trenches paralleling and crossing major highway construction.

How the Sheepsfoot Roller is Constructed. Here are a few of the pertinent facts about the sheepsfoot and its construction. The two drums are constructed with 24-inch pipe, sealed on each end with ½-inch steel plate attached to a truck axle. Each roller weighs 1150 pounds empty. To obtain faster and more complete compaction, we have added 850 pounds of metal shot in each drum.

There are 49 sheepsfeet on each drum, spaced to obtain complete coverage of the backfill when the two rollers are used in tandem as shown. The addition of a metal frame, through which the drums revolve, in conjunction with cleaner blades, eliminates the accumulation of mud and dirt. The frame assembly also helps to stabilize the rollers.

The bridle connection is stationary on a medium size bulldozer, but is connected to a tongue, or tow-bar, with a swinging hitch. This latter type connection maintains stability of the sheepsfoot in the trench as it allows both vertical and horizontal motion and allows the center of pull to remain centered in the ditch. Particularly is this true and necessary as the backfill and elevation of the trench reaches normal or undisturbed levels of the surrounding terrain.

Costs. Actual field studies have revealed that backfill and compaction, to meet Texas Highway Department specifications, by the sheepsfoot, has surpassed our fondest hopes. The air-tamp method has cost 5.6 cents per cubic foot when our men exerted an extreme effort on some 500 feet of open trench. The hydro-tamp method has cost 7.2 cents per cubic foot, which represents maximum results on 300 feet of open trench. The sheepsfoot method has *actually cost only 0.9 (9/10 cents) per cubic foot.*



Improved model of roller has conventionally shaped "feet" and new towing linkage which permits quick shifting of pull direction. Tongue on either end and swinging tow bar enable operator to quickly fasten or release clevises at either end.

Maximum results have not been attained, but we optimistically anticipate that an experienced crew can compact, to highway specifications, 5,000 feet of trench during a 10-hour day and that backfill and compaction costs will be reduced 25 or 30 to 1 over other known methods.

How it is used. As a rule, the first *lift* of earth backfill is carried to about 6 inches of cover over the pipe. Backfill is then added in four to 6-inch lifts until the ditch has been filled, depending on the type of soil and its moisture content. Once the compaction by this method has been completed, the backfill will withstand any of the various methods of testing.

Members of the Texas Highway Department have enthusiastically accepted the sheepsfoot and the results obtained by its use. As the highway program expands, we feel this tool will find acceptance in other states for other pipe line companies.

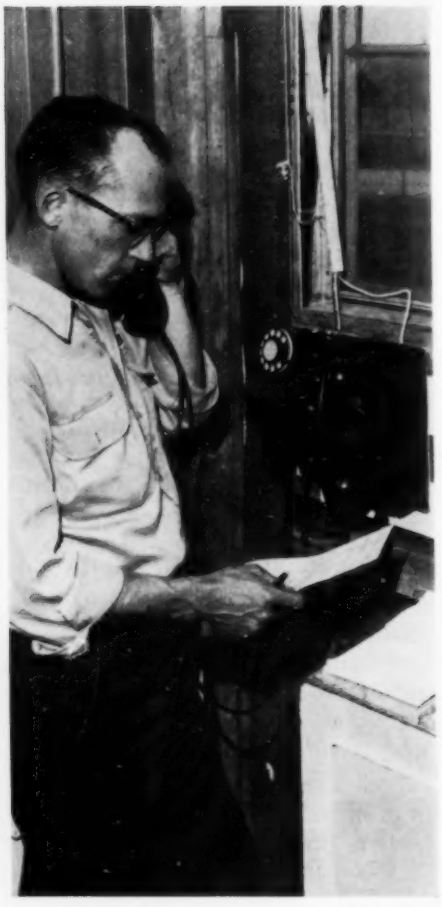
About the Author

W. C. Dahlman, chief engineer of Houston Natural Gas Corporation, has served in several engineering and managerial capacities since joining that company in 1942. Following graduation from the Texas College of Arts & Industries with a BS in gas engineering in 1938, his first engineering assignment was with Lone Star Gas Company. Dahlman has been active in many industry groups including the AGA, SGA, TSPE and the Houston Engineering and Technical Society, plus various offices in civic groups. He is a registered professional engineer in Texas.

ACKNOWLEDGMENT

Special recognition for development of the ditch sheepsfoot roller should be given to several imaginative and practical Houston Natural men. W. O. Hopfe, assistant superintendent of the Houston district and L. J. Elling, design engineer, conceived the original approach to the roller design. Details of fabrication and field modifications that made its operation highly successful were largely the results of efforts by Hopfe and his personnel.

The tankless terminal loads a tank truck directly from the pipe line near Trenton, Mo. This operation has been in use more than a year. It is so successful that Standard Oil Company (Indiana) plans four similar terminals for construction this year.



FIRST STEP: Driver calls dispatcher in Chicago to make sure the product he needs is flowing past Trenton in the pipe line as scheduled.

Tank Trucks Load Products Directly from Pipe Line

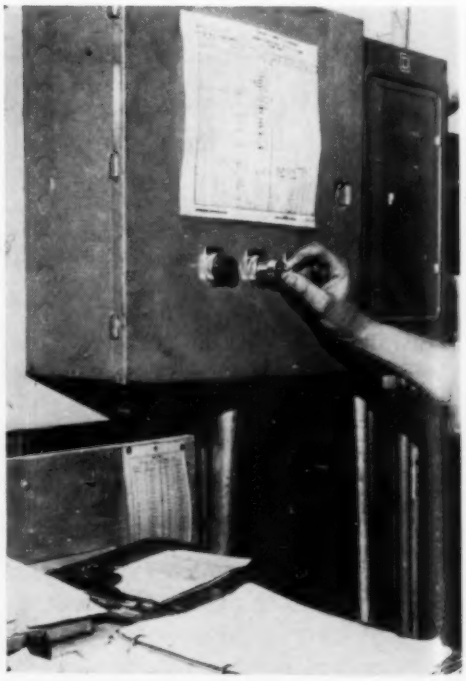
MOST PRODUCTS pipeliners have wondered at one time or another why someone didn't devise a means of loading tank trucks directly from the pipe lines without the usual storage tanks and terminal set up.

Standard Oil Company (Indiana) has done just that. F. Cushing Smith, Standard's general manager of supply and transportation, has announced that the company has completed more than a year's pilot operations at the world's first tankless take-off at Trenton, Mo. Tank trucks load gasoline or heating oils directly from the pipe line as the tenders of products flow by to supply nearby bulk plants more economically than before.

The Trenton terminal features automated designs with a remote control for the take-off valves. This remote control is coupled with the local control of loading by the truck driver, who operates the loading valve and its meter by key.

When the transport truck driver arrives at the terminal, his first task is to check by phone with the company's central pipe line dispatcher at Chicago to make sure that the product he needs is flowing past Trenton at the time as scheduled. If so, the dispatcher releases a motor-operated valve at Trenton from Chicago by dialing a telephone code number. The driver then uses a key assigned to him to unlock the valve and its meter at Trenton, and fills his tank. The valve closes automatically when the driver's order is filled.

Standard plans three additional tankless terminals in 1960, one near St. Joseph, Mo. and two in Michigan, near Constantine and Girard. A modified key-stop take-off is also planned for Cedar Rapids, Ia.



FOURTH STEP: Driver unlocks a key-operated control which permits the dispatcher to dial open the valve for

SECOND STEP: Dispatcher confirms the tender, dials a remote-control telephone code number which releases motor-operated valve at the Trenton terminal, which in turn permits the driver to load his truck directly from the line.

THIRD STEP: The driver selects his particular key to unlock the valve and its meter.

desired product. The valve closes automatically when the driver's order is filled.

FIFTH STEP: Driver inserts the delivery ticket into printing meter before taking load from pipe line.

SIXTH STEP: Flash point of each load of heating oil is tested before transport truck leaves premises.

Pump Station Operates Unattended Without Communications!

Power level controller with built-in logic selects pumps, power levels, and minimizes throttling and surges

By R. D. Pfluger
Shell Pipe Line Corporation, Houston

AUTOMATION OF PETROLEUM pipe line pump stations has in general followed one narrow path: The remote control facilities have been used to bring the control of several pump stations within reach of one central operator. This method of automation has resulted in an improvement from an economic viewpoint. However, from an operations viewpoint, it has several weaknesses. Among these are: *(1) vulnerability of control to communications and remote equipment outages, and (2) excessive burden on the central operator due to menial tasks that he must perform to control each station.*

Local-Automatic Controls. After experiencing these troubles with the remote control method of automation, it became apparent that to eliminate all of the problems, a form of local-automatic control would be needed. Local-automatic control had been used quite extensively and successfully on one- and two-pump unit stations which required only a minimum of built-in control intelligence, but never, to our knowledge, on a four-pump unit station on a multi-station, high-capacity pipe line.

The local-automatic philosophy was further investigated to determine the feasibility of this form of control. This investigation entailed a market search for such a control system, but none was available. Several manufacturers indicated an interest in building the control device to our specifications, and at an attractive price.

Control Simulation Study. To determine the feasibility of this type of automation and the operating requirements of the control device, a control simulation study was performed. A preliminary study was made using an analog computer set up as a mathematical model of a 435-mile 10-station pipe line which was being considered for further automation. Each station has four-pump units. The analog computer was chosen because of the ease of insertion of data, and the logic of the control system is simulated manually; thus, no extensive programming changes are required when examining radically different logical procedures. The analog computer simulation was performed using the characteristics of an average crude oil and was intended to outline the control system logic that would be required. Upon completion of this phase and determination of the control system logic, a program was written using a digital computer.[1] This later method allowed us to evaluate the effects of various crude characteristics upon the operation and stability of the control system and the pipe line.

Following the successful completion of the control simulation studies, specifications for the manufacture of a prototype controller were written. Arrangements were made for the detailed design and manufacture of the instrument.

This control device has been designated as a *power level controller.*

FUNCTIONAL DESCRIPTION OF POWER LEVEL CONTROLLER

A prototype controller was designed to control automatically the operation of a four-pump unit pipe line station. The units are electrically driven constant speed centrifugal pumps equipped with sequentially operated switchgear and a complete protective device scheme.

Controls. The pump station is equipped with a pressure control system which includes a throttle valve and a suction-discharge pressure controller.

The horsepower ratings of the pumps at this station are: Unit 1—750 hp, No. 2 and 4—1,250 hp, and No. 3—1,500 hp. These are piped so that any combination of units may be run together; thus, the hydraulic boost provided by the stations can be varied in incremental steps by changing the combination of pumps that are operating. To each combination has been assigned a numerical value representing the relative power furnished. This designation is referred to as a *power level.* Shown below is a listing of the power levels available from the units described above.

Power Level	Pump Unit Combination	Horsepower
0	None	0
1	1	750
2	2 or 4	1250
3	3	1500
4	1 & 2 or 1 & 4	2000
5	1 & 3	2250
6	2 & 4	2500
7	2 & 3 or 3 & 4	2750
8	1, 2 & 4	3250
9	1, 2 & 3 or 1, 3 & 4	3500
10	2, 3 & 4	4000
11	1, 2, 3, & 4	4750

Shown in Figure 1 is a graph of pressure boost versus throughput rate for these power levels at a typical station.

What It Does. As the name implies, the controller regulates the power level at which the pump station operates. This is accomplished by use of logical circuitry which has sufficient intelligence to perform the following functions:

1. Increase the operating power level of the pump station providing that (a) the station is operating below the desired power level and (b) the hydraulic condition of the pipe line will permit.

2. Decrease the operating power level of the pump station if excessive throttling exists across the station throttle valve.

3. Operate the station at an alternate power level if the desired power level is inoperative due to a locked out pump unit or units.

4. Automatically start and stop the pump units in the proper sequence as required by the conditions listed above or upon a command for a power level change as would be required to change the throughput rate of the pipe line.

All of these control features are accomplished locally and automatically. The only operational duty to be performed manually is selection or change of the power level at which the station is to operate. The frequency of the selections will vary from pipe line to pipe line, but in general, a power level change will be made only when required to achieve over-all power cost optimization. The station will operate itself at the selected power level, or as near to this power level as hydraulic conditions or malfunctioning pump units will permit.

Sequence of Operations. The controller follows a definite sequence of operations when increasing or decreasing the operating power level. This sequence is determined by the desired level at which the station is to operate, and this sequence has been designed so that incrementation and decrementation can be accomplished with only a minimum number of pump unit condition changes.

To illustrate this sequence, the following listing shows the steps that would be required to bring the station from a shutdown (power level 0) condition to power level 8.

Step	Power Level	Pump Units Operating
Initial	0	None
1	2	4
2	4	1 & 4
3	6	2 & 4
4	8	1, 2 & 4

The controller will follow this same sequence, except in the reverse order, to decrease the operating power level. It will be noted in the listing above that pump unit No. 1 is run at power level 4 and then stopped and restarted for power level 8. This requires one extra start on this unit, and is included in the sequence so that the incremental steps will be as small as possible to reduce transient pressure surges.

The operating power level is increased only when the station is operating below the set power level and the hydraulic conditions will permit. The hydraulic conditions which must be satisfied before raising the level are

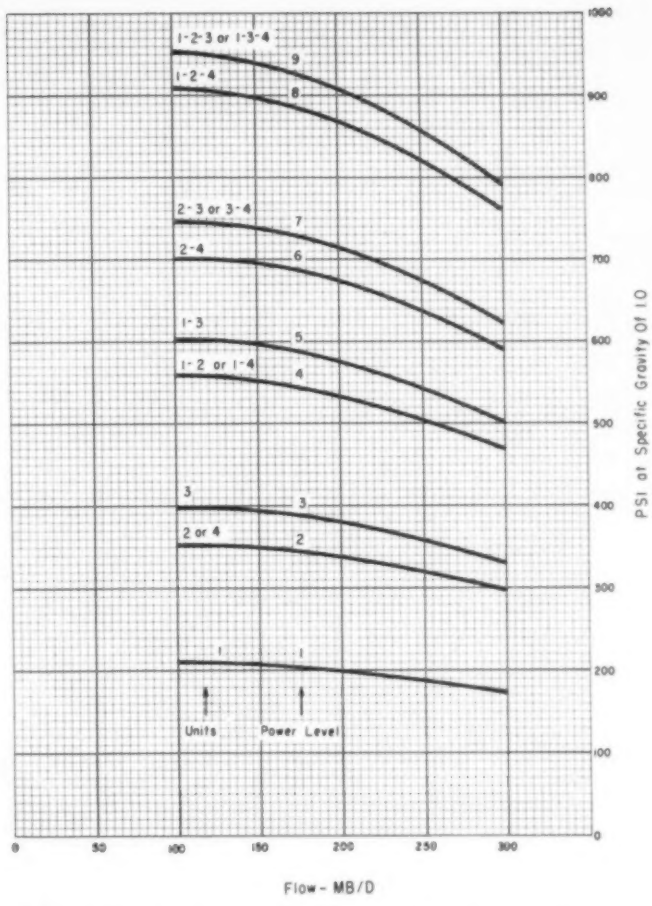


FIGURE 1—Pressure boost versus throughput rate for power levels at a typical crude pipe line station.

minimum flow, minimum suction pressure and maximum case pressure. The purpose of these three hydraulic conditions is as follows:

Minimum Flow: A minimum amount of flow must be established to prevent static pressures in the pipe line under no-flow or line shutdown conditions from starting the pumps.

Minimum Suction Pressure: A minimum amount of suction pressure is required before the operating power level can be increased, thus insuring that the larger power level will not pull down the suction pressure to a point below the rated minimum net positive suction head of the pumps.

Maximum Case Pressure: The case pressure of the station must be below a maximum value before incrementation is accomplished to prevent the larger power level and pressure boost from exceeding the pipe line pressure limit.

All three of these hydraulic conditions must be satisfied for a pre-set time before the incrementation step is initiated and up until the time that the step has been accomplished. If any of these conditions violates the set limits during this time, the incrementation is aborted and the pump station is allowed to operate at the original power level until the hydraulic conditions are again within limits. This procedure of examining the hydraulic conditions and then incrementing the power level is

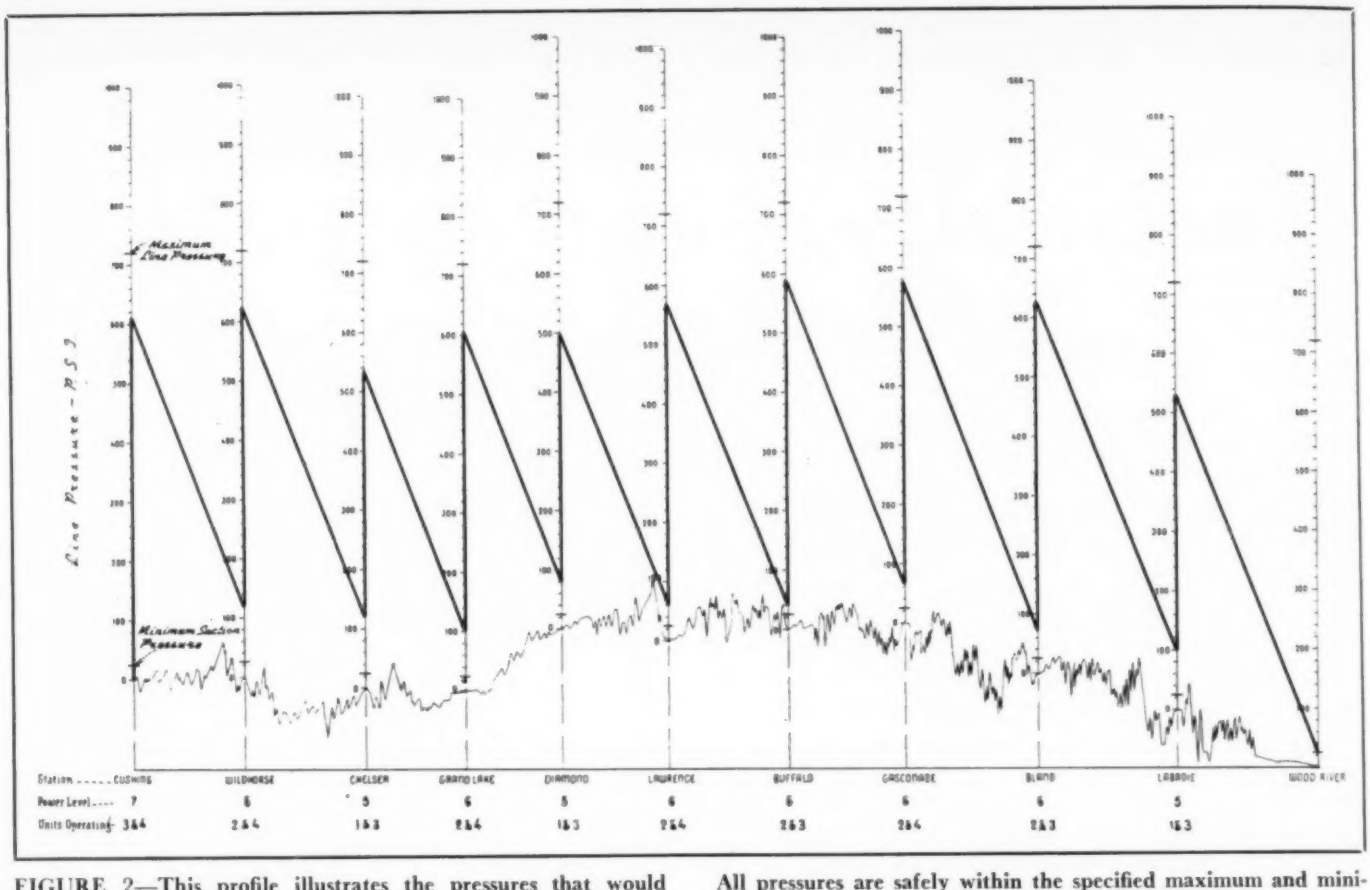

Maximum Line Pressure
Minimum Suction Pressure
Line Pressure - P.S.I.
Station ..... CUSHING WILDHORSE CHELSEA GRAND LAKE DIAMOND LAWRENCE BUFFALO GASCONADE BLAND LABADIE WOOD RIVER
Power Level 7 6 5 6 5 6 6 6 6 5
Units Operating 384 284 183 284 183 284 283 284 283 183

FIGURE 2—This profile illustrates the pressures that would exist under normal operation at a thruput rate of 267,060 bpd. All pressures are safely within the specified maximum and minimum values and no throttling exists.

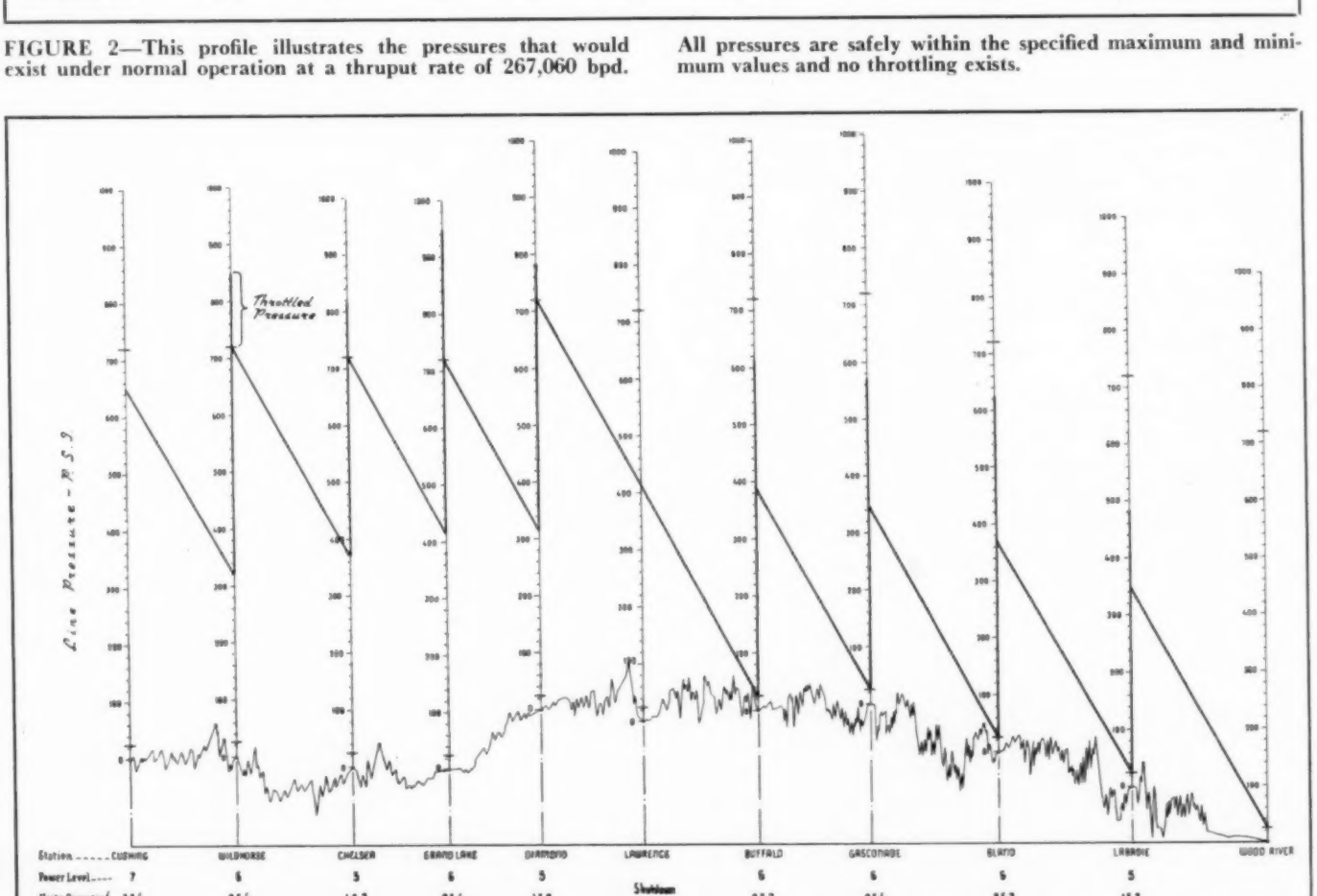

Throttled Pressure
Line Pressure - P.S.I.
Station ..... CUSHING WILDHORSE CHELSEA GRAND LAKE DIAMOND LAWRENCE BUFFALO GASCONADE BLAND LABADIE WOOD RIVER
Power Level ..... 7 6 5 6 5 Shutdown 6 6 6 5
Units Operating 384 284 183 284 183 283 284 283 183

FIGURE 3—Pressures that would exist if Lawrence station were shut down and all other stations continued to operate at their original power level. This reduces the thruput from 267,060 bpd to 219,230 bpd and has caused all stations except Cushing to throttle. The stations upstream of Lawrence are throttling to limit the station discharge pressure to that of the maximum line pressure limit. The stations downstream of Lawrence are throttling in order to slow down the thruput rate and, thus, maintain minimum suction pressure.

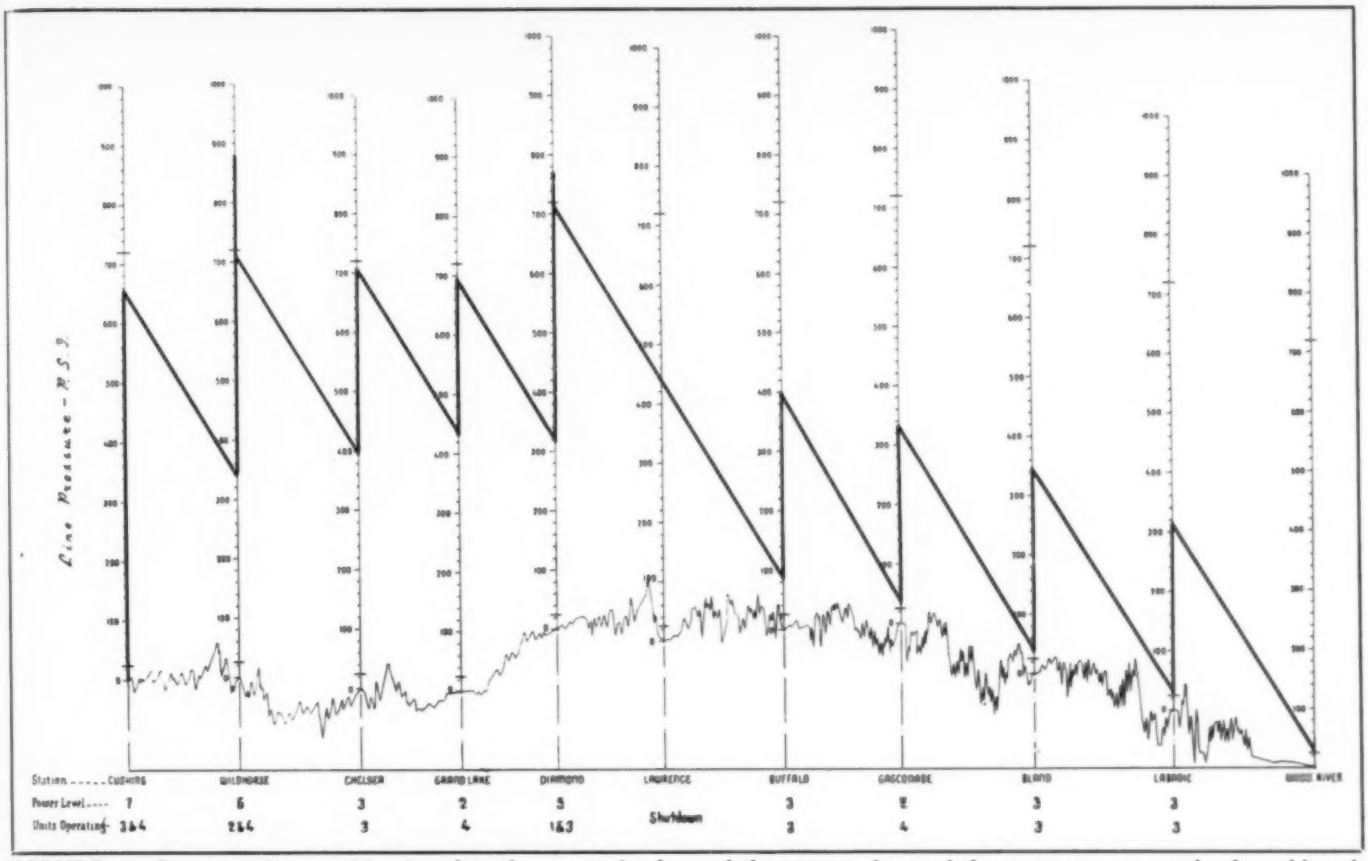

Line Pressure - PSI
Station ..... CUSHING WILDHORSE CHELSEA GRAND LAKE DIAMOND LAWRENCE BUFFALO GASCONADE BLAND LABADIE WIDE RIVER
Power Level ..... 7 6 3 2 5 Shutdown 3 2 3 3
Units Operating 3&4 2&4 3 4 1&3 3 4 3 3

FIGURE 4—Pressures that would exist after the power level controllers at each station have decremented the power level at those stations where the throttled pressure was excessive. The following decrementations have been made.

Station	Decrementation
Chelsea	Upstream pump unit shut down—Power Level reduced from 5 to 3
Grand Lake	Upstream pump unit shut down—Power Level reduced from 6 to 2
Buffalo	Upstream pump unit shut down—Power Level reduced from 6 to 3
Gasconade	Upstream pump unit shut down—Power Level reduced from 6 to 2
Bland	Upstream pump unit shut down—Power Level reduced from 6 to 3
Labadie	Upstream pump unit shut down—Power Level reduced from 5 to 3

The action of the power level controller has eliminated the throttled pressure at all stations except Wildhorse and Diamond. At Wildhorse the throttled pressure does not exceed 75 percent of the pressure boost of the upstream pump unit, thus, this unit was not shut down. The throttled pressure does exceed 40 percent of pressure boost between power level 6 and 4, and if Lawrence station remains inoperative for a period of 10 minutes, the power level at Wildhorse will be decremented to power level 4. At Diamond the throttled pressure does not exceed either value of throttled pressure and the station will continue to throttle.

repeated until the pump station is operating at the desired power level.

Decreasing the Power Level. The operating power level of the station may be decreased by two methods. The first is to lower the operating power level in the sequence described previously, or to lower the operating level by a two-power level step. This method of decrementation is used when a pressure in excess of approximately 40 percent of the pressure boost furnished by this two power level step has been throttled by the station throttle valve for a period of approximately 10 minutes. This condition of throttling would exist when one of the adjacent pump stations has a malfunctioning pump unit, the line throughput rate is changed, or by viscosity differences in the oil stream adjacent to the station. The percentage of throttled pressure stated above was determined through the control simulation studies as being optimum value. The value of 10 minutes allows sufficient time for a malfunctioning unit to be restarted.

The second method of decrementation is to shut down the upstream pump unit when the throttled pressure exceeds 75 percent of the pressure boost furnished by this unit for a period of approximately 30 seconds. A throttled pressure of this magnitude would be caused by shutdown of an adjacent station or some other major fault.

Eliminates Wasted Power. The purpose of the decrementation schemes discussed above is to eliminate as nearly as possible any throttled pressures and consequent sources of wasted power.

The time delay action built into both the incrementation and decrementation schemes is to prevent action by the controller during transient pressure conditions.

To further illustrate this incrementation and decrementation action, a series of hydraulic profiles have been prepared, showing a pressure scale at each pump station. The maximum pipe line pressure limit is 720 psi, the minimum station suction pressure is 25 psi. The pressure control system will throttle as is necessary to maintain the pressures within these limits. Figures 2, 3 and 4 illustrate the decrementation to reduce throttled pressure or wasted power following an upset condition. Figures 5, 6 and 7 illustrate the incrementation action following the correction of the upset condition.

Built-in Logic. In addition to controlling the operation of the station by increasing and decreasing the power level to meet the hydraulic conditions, the power level controller will also choose an alternate power level at which to operate the station if the desired power level becomes inoperative due to a locked-out unit. By refer-

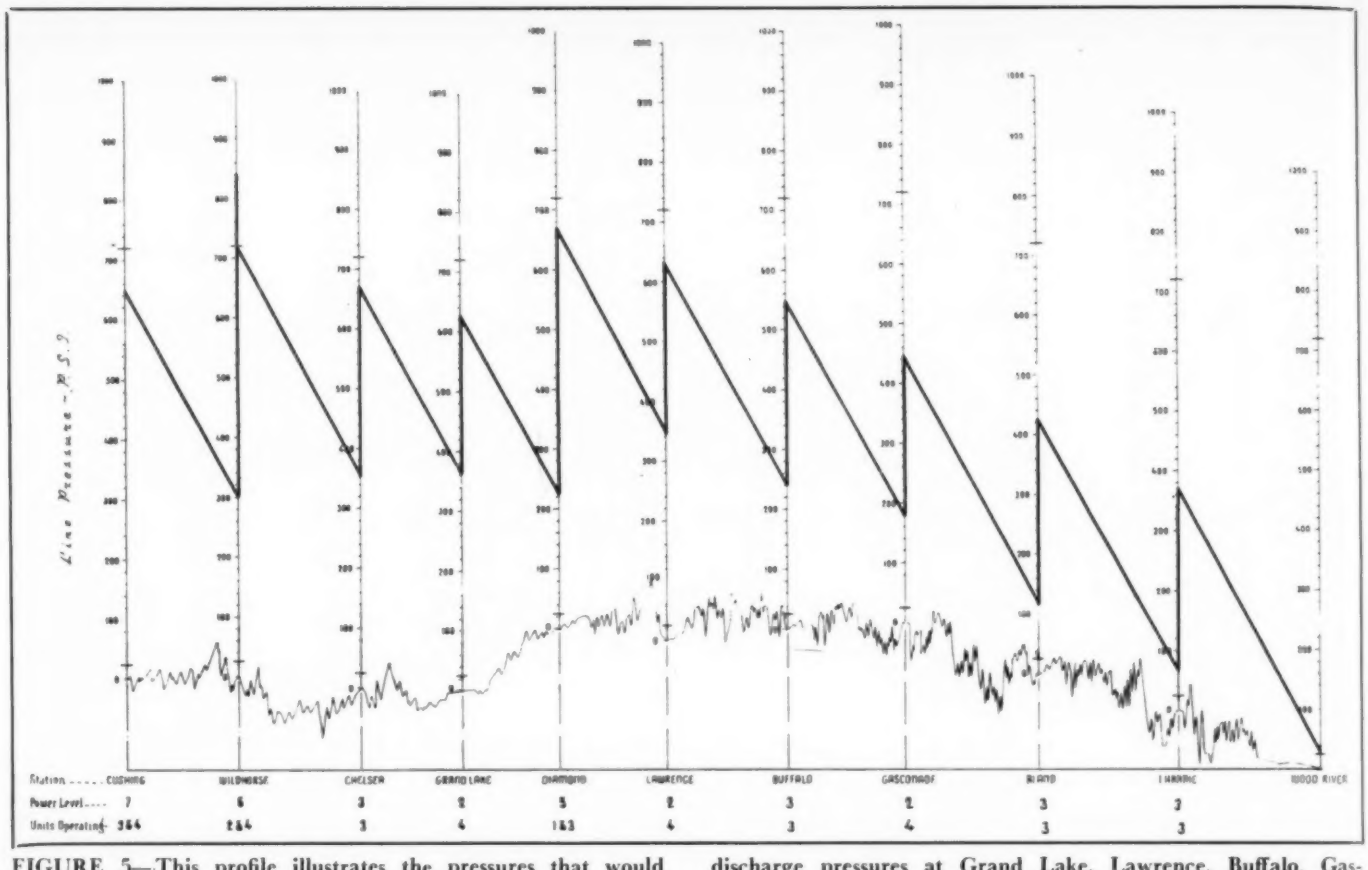

Line Pressure - P.S.I.
Station ..... CUSHING WILDHORSE CHELSEA GRAND LAKE DIAMOND LAWRENCE BUFFALO GASCONADE BLAND LABADIE WOOD RIVER
Power Level..... 7 6 3 2 5 2 3 2 3 3
Units Operating 3&4 2&4 3 4 1&3 4 3 4 3 3

FIGURE 5—This profile illustrates the pressures that would exist following an increase of the Lawrence station power level from 0 to 2. This incrementation has raised the throughput rate from 210,800 to 220,100 bpd, and has brought the suction and discharge pressures at Grand Lake, Lawrence, Buffalo, Gasconade and Bland stations within safe limits for incrementation of their respective power levels.

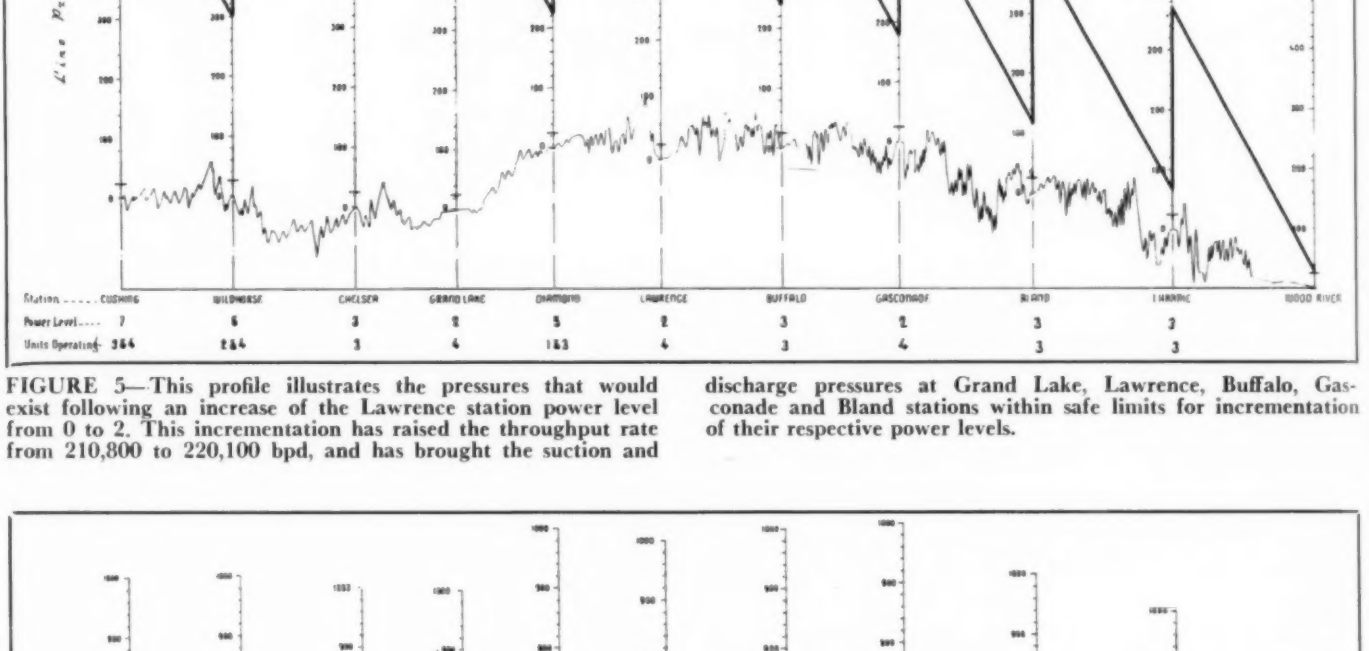

Line Pressure - P.S.I.
Station ..... CUSHING WILDHORSE CHELSEA GRAND LAKE DIAMOND LAWRENCE BUFFALO GASCONADE BLAND LABADIE WOOD RIVER
Power Level..... 7 6 3 4 5 4 5 4 5 3 3
Units Operating 3&4 2&4 3 1&4 1&3 1&4 1&3 1&4 1&3 3

FIGURE 6—This profile illustrates the pressures that would exist following an increase of power levels at the Grand Lake, Lawrence, Buffalo, Gasconade and Bland stations. The thruput rate has been increased to 244,820 bpd. Chelsea, Grand Lake, Lawrence, Buffalo, Gasconade, Bland and Labadie stations are still operating below their respective set power levels. The suction and case pressures at these stations are within safe limits for incrementation.

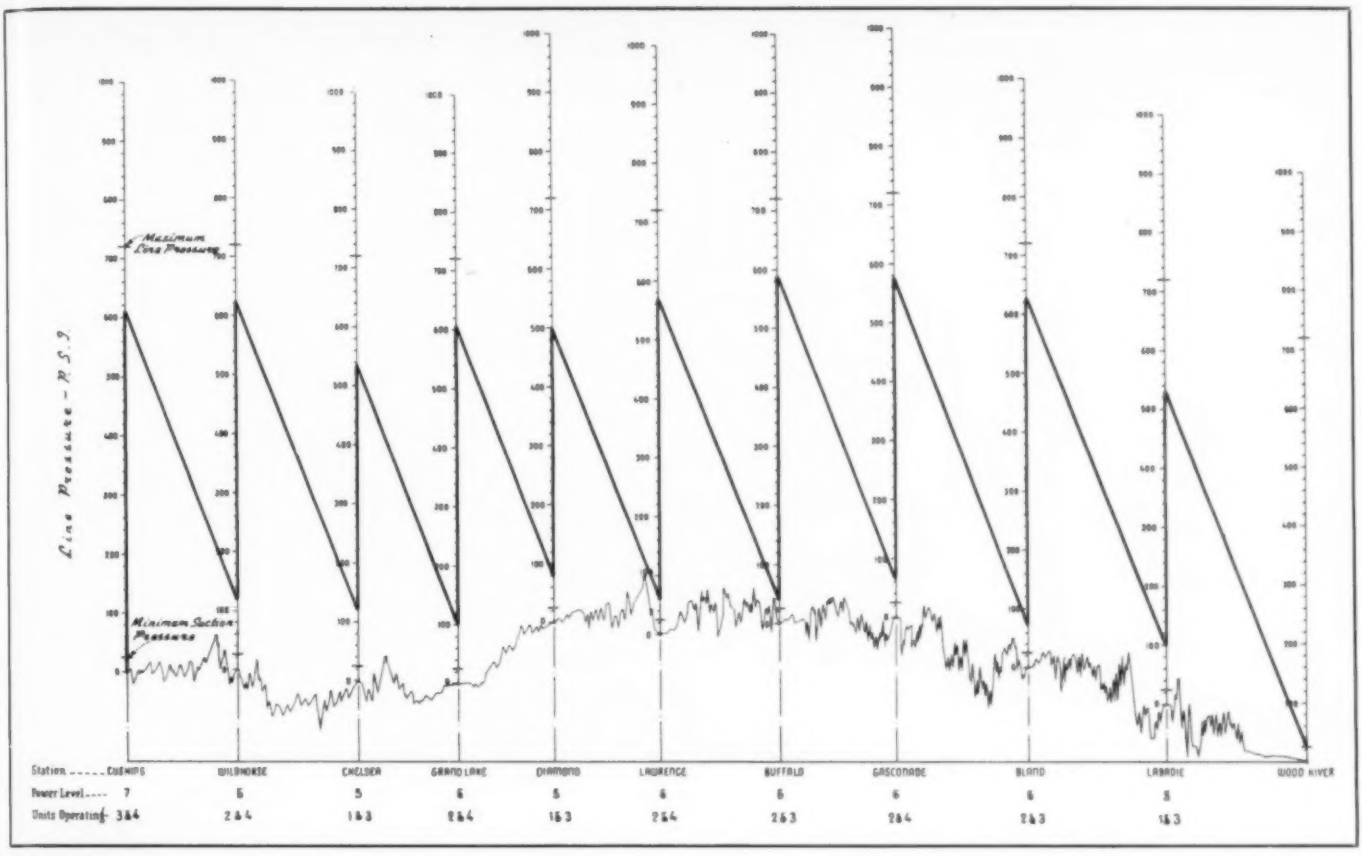

Line Pressure - P.S.I.
Maximum Line Pressure
Minimum Suction Pressure
Station ..... CASMIR WILDHORSE CHELSEA GRAND LAKE DIAMOND LAWRENCE BUFFALO GASCONADE BLAND LABADIE WOOD RIVER
Power Level..... 7 5 5 6 5 6 6 6 6 5
Units Operating 3&4 2&4 1&3 2&4 1&3 2&4 2&3 2&4 2&3 1&3

FIGURE 7—This profile illustrates the pressures that would exist following an incrementation at Chelsea, Grand Lake, Lawrence, Buffalo, Gasconade, Bland and Labadie stations. The thruput rate has been increased to 267,060 or to the rate preceding the shutdown of Lawrence station. All stations are now operating at their respective desired or set power levels and the line operation is back to normal.

ring to the listing of power levels, it will be seen that pump units 1, 2 and 4 are required to achieve power level No. 8. If any of these units becomes locked out due to the action of a protective device, this power level is inoperative. The controller will then choose the next lower power level which can operate and does not include this locked-out unit. If unit No. 4 were locked out, the controller would then operate the station at power level 7 or units 2 and 3. When the malfunction on unit No. 4 is corrected and the unit is restored to service, the controller will then operate the station at the desired power level or power level No. 8.

Several of the power levels may be achieved by operating either pump unit No. 2 or 4 since these units are identical in size. A control is provided on the front cover of the controller to enable the operator to select which of these units is to run when this choice exists. This selection will be voided if the preferred pump unit is locked out.

PROTOTYPE POWER LEVEL CONTROLLER

A prototype model of the controller was built to test under field conditions the local-automatic control philosophy. The prototype model is shown pictorially in Figures 8, 9, 10 and 11.

Results of Field Tests. Extensive field tests have been performed to evaluate the operation of the controller. Abnormal conditions were created at the control station as well as at other stations along the pipe line in order to simulate operating upsets which might occur. In every case the controller performed as required. Since these initial tests some five months ago, the instrument has remained in control of the pump station which has been operating unattended and without communications with completely satisfactory results. During this period a change in power level has been required on an average of twice per day.

HOW LOCAL-AUTOMATION IS PROVING OUT

In conclusion, it is believed that control devices of this nature have a definite place in the automation of pipe line systems, both presently operating and those that will be built in the future. The local-automatic philosophy of control properly and fully applied becomes a very essential link in the pipe line control system chain.

In essence, this philosophy places the control device directly at the point to be controlled. By doing this, the control loop is closed and the only external control function required is to periodically adjust the set level of the station to comply with station maximum power demand requirements and pipe line flow rates.

Control devices of this nature will greatly simplify the job of the local operator or central dispatcher, and will insure better operation. Such a controller will automatically switch units, select the proper operating level for the station when malfunctions occur, and will automatically adjust the operating level of the station to meet hydraulic conditions. By continuously monitoring the station, it is possible to initiate control action before a manual operator would be aware of the conditions that require corrective action.

A local-automatic controller can achieve complete control of the station without full-time attendance or a communications link between the central operator and the station. If remote control, remote monitoring, or

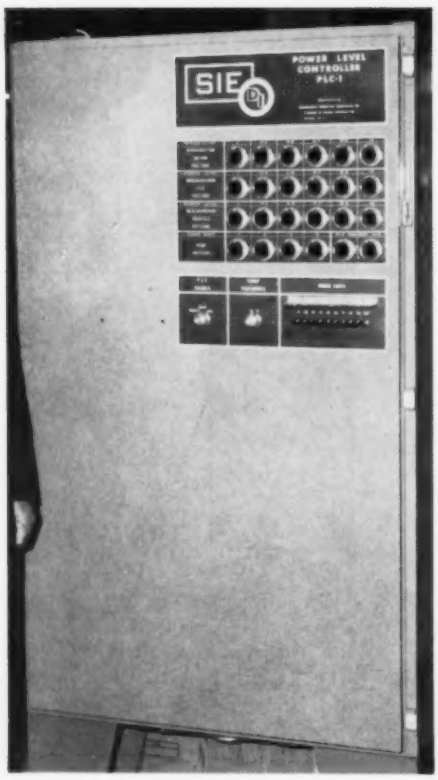


FIGURE 8

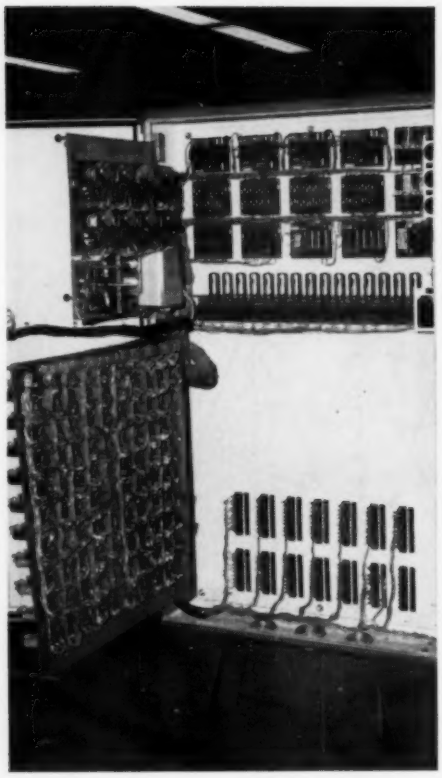


FIGURE 9

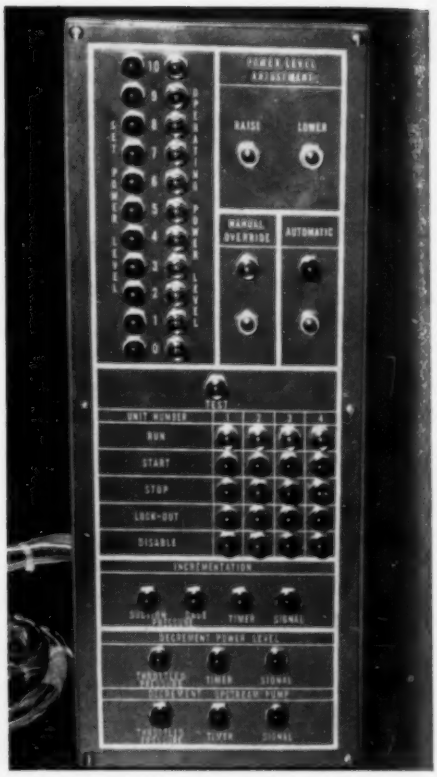


FIGURE 10

Figure 8 shows a front view of the controller. Located on the front door are the adjustable incrementation and decrementation pressure set points, the on-off switch, the pump preference selector, and a manually set limit switch to establish maximum power level at which station can operate. The latter item was added as a safety feature to prevent accidental setting of the station at a level greater than desired. Figure 9 is an interior view of the controller with the relay panels swung out. Located beneath the time delay relays are the power supplies, one for the pressure set points, the other for relay drive. Pressure sensing amplifier-comparators (4) are the small modular boards in the top row on back panel of enclosure. Remaining modular boards are power supplies and output relays for the amplifier-comparators and boards of diodes used for "or" logic and d.c. voltage isolation. Tube-like devices are latch type mercury wetted relays which provide memory to the controller. At bottom of the controller are the terminal points for interconnections between the controller, switchgear and control panel. Figure 10 shows the local control panel. From this panel, an operator can control and monitor operation of the station.

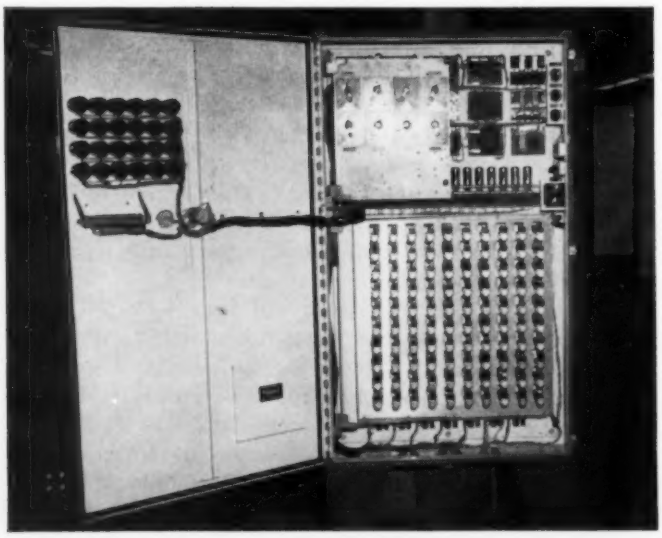


FIGURE 11—Interior view of controller. On the top hinged panel are located the time delay relays; on the lower hinged panel are the telephone type relays required to accomplish the logic functions of the controller.

computer control is considered necessary, a simplified system can be economically installed using the Power Level Controller as a part of the system. This will assure continuous operations during outage of the communications system, remote control system, or the computer, and will definitely contribute to the need for a smaller and simpler control computer.

In completing the automation of the Ozark Pipe Line, our company plans to install a power level controller at each of five stations and to operate these stations unattended and without communications; thus, a considerable capital savings will be realized.

LITERATURE CITED

[1] Digital Simulation of Pipe Line Operations, by T. R. Young, Page 16 PIPE LINE INDUSTRY, May 1960.

About the Author

R. D. Pfluger is an engineer with Shell Pipe Line Corporation. He joined the company after graduating from The University of Texas in 1956 with a degree in electrical engineering. For the first three years he worked in the Engineering Department and Mid-Continent Division where his activities were concerned with supervisory control, telemetering, etc. For the past year and a half he has worked on the design of electrical control equipment for the local phases of pump station automation.

FIGURE 1—At the Control Center in Colorado Springs. Data can be read out at desired intervals on printer. On the wall at upper left is station monitor. New discharge pressure set point can be initiated in keyboard at left.

FIGURE 2—Close-up of station monitor in Control Center.

Newest Control Idea: Local Automation, Remote Supervision

Colorado Interstate's new system controls engine selection, speeds and other functions locally. The dispatcher sets discharge pressure remotely

On May 20, Colorado Interstate Gas Company initiated what may be the most practical approach to automation in the gas industry yet. In a brief "button pushing" ceremony at Colorado Springs, company Vice President N. B. LauBach inaugurated formal use of a control system which eliminates any possible trouble that could come from an outage of a communications system —yet, at the same time, preserves the very purpose of the communications system.

So far as control systems are concerned, this is the nearest approach to having your cake and eating it too. Local automation—with closed circuits and built in logic —handles all operations at the compressor station, which, in this case, is near Springfield in southeastern Colorado. Thus local instrumentation—primarily solid state—selects engines for service on the line, starts them, controls their speed, takes them off the line, etc.

Meanwhile, the dispatcher in Colorado Springs, 160 miles away, exercises supervisory control over the station via microwave radio. Yet if the communications should fail, the station will continue to operate under local automation with closed circuitry.

This new system is so reliable and foolproof that Colorado Interstate's management has announced plans to incorporate the same controls at new stations proposed in the company's expansion program which is now awaiting decision by the Federal Power Commission.

Comparison With Manual Operations. Colorado Interstate's Springfield station was built in 1953. Today it has four two-cycle engine compressor units with a

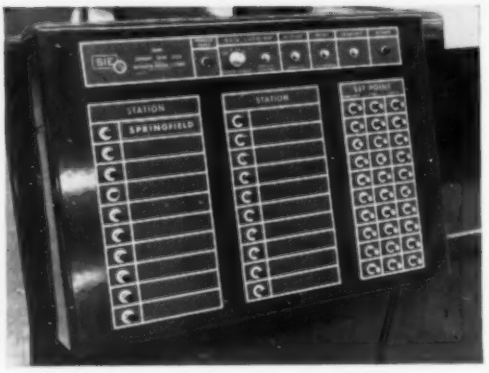


FIGURE 3—Control center keyboard.

FIGURE 4—Concrete block building at left houses controls for automatic operation of the Springfield compressor station. Remote signals and monitoring come and go via the microwave tower in center.

total of 5,400 horsepower. Under manual operation, the local operating crew got instructions from the dispatcher at regular intervals and they started, stopped, speeded-up engines, opened or closed pockets to maintain the required discharge pressures. In addition, they kept a sharp watch on the engine for malfunctioning equipment, low oil pressure, etc.

The new control system performs these routine tasks of station operation automatically, more rapidly and free of the possibilities of human error. In addition, the system recognizes and takes into consideration all possible upset conditions on the line, maintains established discharge pressures by automatically regulating equipment and monitors the mechanical equipment to provide completely fail-safe operation in the event of an equipment failure.

The dispatcher simply telemeters the required discharge pressure over microwave, changing it as he desires without any local aid. Also, he can monitor at the control center the station discharge and suction pressures and the number of engines on the line.

SYSTEM DESIGN

From the outset, Colorado Interstate established basic operating requirements which the control system had to meet. Here are the main ones:

1. The dispatcher should be able to direct a compressor station to automatically develop and maintain a certain discharge pressure by remotely transmitting only the discharge pressure set point to that particular station as desired.

2. Each compressor station must function, at all times, as a single self-controlled unit for the delivery of a desired discharge pressure in the most economical method possible.

3. The dispatcher must have knowledge of the power being used at each station and the remaining power available.

4. The system must produce a printed log of compressor station variables and conditions at the control center. The logging operation is initiated manually or at selected, automatically programed intervals.

5. The safest possible operating conditions must be maintained at all times.

HOW THE SYSTEM WORKS

To better understand the automatic supervisory control system, let's follow it through one complete sequence. Assume the dispatcher at Colorado Springs wants to increase the station discharge pressure to 850 psi.

A glance at the station monitor in the upper left of Figure 1 and shown in detail in Figure 2, shows a suction pressure of 550 psi, a discharge pressure of 750 psi and a discharge pressure set point of 750 psi. In addition, it shows the number of engines out of service (if any) and if the station is locked out of service or on manual control due to equipment failure. On the data logger (Figure 1) the dispatcher reads the complete story of station conditions. This data logger is pre-programed to print out at either 15, 30 or 60-minute intervals or on demand. The format is:

Time	Suction Pressure	Discharge Pressure	Set Point	% of Speed	No. of Engines Running
0130	550	750	750	75	3

To raise the Springfield discharge pressure, the dispatcher initiates a new set point—850—(see Figure 3), by setting the station address and set point into the keyboard and pushing the transmit button. Internal circuitry converts this information into an electrical coded message that is transmitted to the station via microwave (Figure 4).

Verification. The station places the setpoint in storage and returns the message to the control center at Colorado Springs for verification. The messages are compared electronically at the control center, and if correct, a verifying message is transmitted to the Springfield station.

If incorrect, an error signal is generated at the control center which causes the message to be re-transmitted. After three unsuccessful attempts at transmission, the system automatically checks the communications system. Set point verification having been received, the addressed

station initiates a sequence of actions to bring the station discharge pressure equal to the set point.

Local Control. The desired set point, in the form of an electrical signal, is used as an input to the discharge pressure controller (Figure 5). Two different control methods are used, engine control and speed control. Engine control provides discrete levels of horsepower so that the number of engines needed on the line are started or stopped; pockets are loaded or unloaded; automatically, as conditions indicate. Speed control provides continuously variable control within the limits of the engines on the line. This is analogous to a "coarse" range control with an associated "fine" control continuously variable over the selected range. When the fine control cannot maintain discharge pressure equal to the set point, the coarse control then switches to the next higher or lower range to correct the situation.

The speed control is a closed loop, proportional-band control device. It consists of a discharge pressure transducer (pressure to electrical), an electronic proportional-band controller and an electrical-to-air converter. The loop is closed through the engine governor to control engine speed.

The engine control consists of three pressure switches, an engine selector panel and engine sequence panels. The pressure switches supply the engine selector with the information required for making the decision to start or stop an engine.

Upon receipt of a new set point, the discharge pressure controller, by comparison of signals, recognizes that a difference between actual discharge pressure and set point exists. The controller generates an "error" signal which increases or decreases the speed of the engines on the line. If this change is not sufficient, the controller sends a signal to the engine selector to load or unload pockets or to add or subtract an engine. In our assumed case, increasing the speeds of the three engines did not raise the discharge pressure equal to the set point and another engine-compressor must be brought on line (Figure 6).

The engine selector (Figure 7) monitors the governor-control air signal to determine the need for starting or stopping the engines and provides start/stop signals to the engine sequence panels in accordance with an established engine selection program. Any engine may be placed in any position in the selector sequence. An "out-of-service" signal from a sequence panel automatically changes the selection sequence.

Pre-Programed Engine Sequence. The engine selector, having received the signal to bring an engine on line, checks the pre-programed engine sequence and signals the proper engine sequence panel to bring its engine on line.

The engine sequence panel (Figure 8) automatically cycles the engine on or off. Complete supervision of engine start-up or shut-down sequence is maintained. Each generated command must be followed by appropriate action on time before the next command is given. Failure of the mechanical equipment to follow the prescribed action in a predetermined time initiates a "fault shutdown" and takes the engine out of service. When the engine sequence panel has completed the engine start sequence it signals the engine selector that the engine is on line.

After the engine selector has received this signal engine

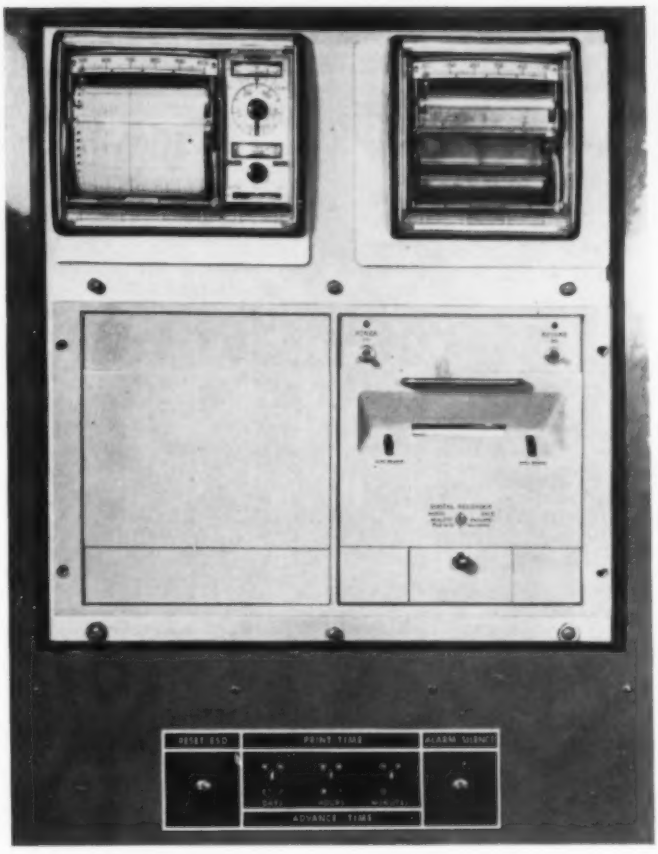


FIGURE 5—Discharge pressure controller and log alarm shut-down at the Springfield station.

FIGURE 6—Interior view of the first remotely supervised natural gas compressor station to be truly automatically controlled on Colorado Interstate's system.

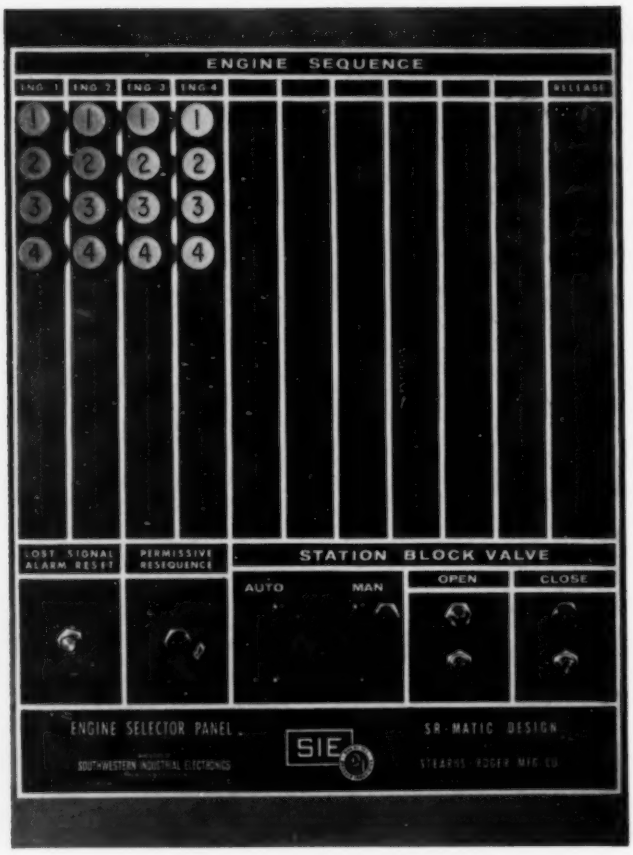


FIGURE 7—Engine selector panel.

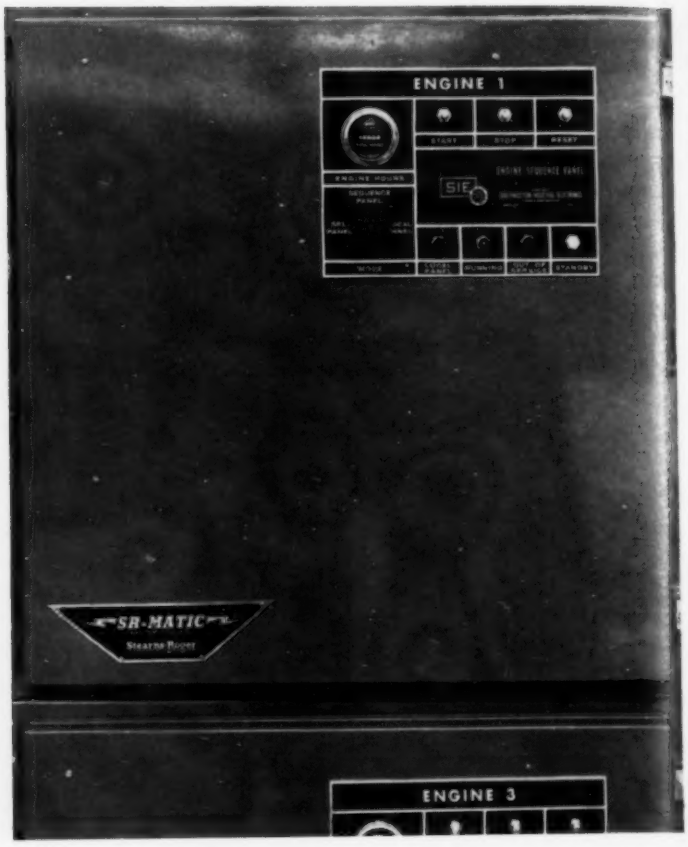


FIGURE 8—Engine sequence controls.

speeds are again varied to bring the discharge pressure equal to the set point.

Log-Alarm-Shutdown. To insure safe operating conditions a log-alarm-shutdown system (LAS) (Figure 5) monitors station operation at all times. This unit recognizes such things as "fire or combustible gas," excessive temperatures in the engine-compressors; lubricating oil level, pressure and temperature; jacket water temperature and flow and many other station safety parameters (Figure 9). The chart lists alarms by group and indicates the action resulting if one of these conditions occurs.

The primary function of the LAS system is the immediate shutdown of affected equipment upon receipt of an alarm. Detection of an abnormal condition is instantaneous and the time from detection to initiation of a shutdown is approximately one-tenth second. In the time required for an operator to go to each engine and check all conditions destructive failure could result before such a check was completed.

The secondary function of the LAS system is to log the alarm which caused the shutdown. The alarm printout contains date, time, engine number and alarm conditions. A typical printout would be:

141118 0106

This tells the station operator that on the fourteenth (14) of the month at 11:18 a.m. (1118), engine number 1 (01) shutdown because of low lubricating oil pressure (06).

No reset of the LAS system is required except in the case of "emergency shutdown" (station shutdown). The other alarm circuits are self-restoring and will automatically reset when the off-normal condition is cleared. After the alarm has been cleared, the engine will resume operation as determined by the engine selector panel.

ALARM IDENTIFICATION CHART

Station Shutdown Alarms

Individual Engine Alarms Identification	OPERATION		
	Log	Alarm	Shut-down
Fire Detector	X	X	X
Gas Detector	X	X	X
Station Discharge Pressure	X	X	X
Scrubber Level	X	X	X
Fan Vibration Switch	X	X	X
GENERAL ALARMS			
Log Manual ESD	X	X	
Fuel Gas Pressure	X	X	
Selector Panel Power Failure	X	X	
Starting Air Pressure	X	X	
Low Instrument Air	X	X	
Incomplete Sequence-Selector Panel	X	X	
Electrical Power to Standby	X	X	
Sequence Panel Power Failure	X	X	
Temperature Scan Group No. 1 (HI)	X	X	X
Temperature Scan Group No. 2 (LO)	X	X	X
Gas Discharge Temperature	X	X	X
Piston Overtravel	X	X	X
Lube Oil Level	X	X	X
Lube Oil Pressure	X	X	X
Lube Oil Temperature	X	X	X
Engine Vibration	X	X	X
Low Lubricator Flow	X	X	X
Jacket Water Temperature	X	X	X
Jacket Water Flow	X	X	X
Engine Overspeed	X	X	X
Stop Failure	X	X	X
Start Failure	X	X	X
Failure to Fire	X	X	X
Engine Started	X		
Engine Stopped	X		

FIGURE 9

The station power system (Figure 10) consists of a 30-ampere, magnetic-amplifier-controlled battery charger and 20-nickel-cadmium cells. In the event of power failure to the station, the 82-ampere-hour capacity of the batteries is sufficient to keep the station operating for approximately 6 hours.

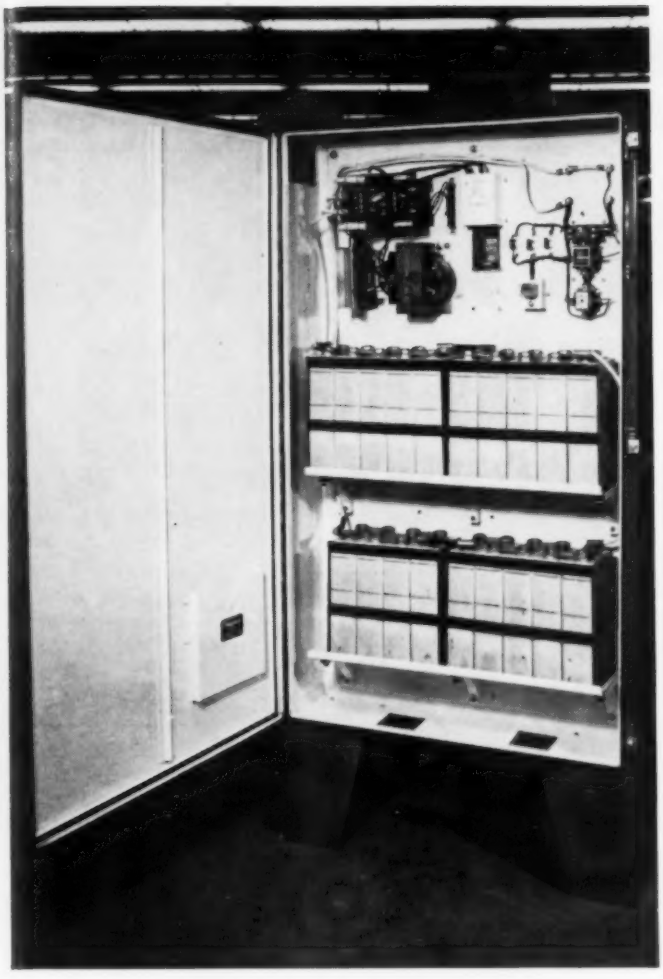


FIGURE 10—Station power supply.

The station control equipment complement is housed in nine dust-proof (NEMA 12) enclosures, eight are connected to form one large (20-foot) cabinet (Figure 11). A wireway mounted across the top of these cabinets brings all connections to the compressor station and its ancillary equipment into one terminal cabinet. All connections are made at the manufacturer's and the unit is tested with field wiring.

The system represents true automation, not remote control, since the entire station is controlled at the point of use. Once the opening parameters have been established, by the dispatcher, the system is entirely self regulating.

Back at the control center, the dispatcher is informed through the station monitor (Figure 12) that Springfield station is now at the desired discharge pressure. The data logger printout now reads:

Time	Suction Pressure	Discharge Pressure	Set Point	% of Speed	No. of Engines Running
0140	550	850	850	65	4

When completed, the system will have a complement of 5 data loggers and may have a computer at the Control Center in Colorado Springs.

The system will log: Pressures, hourly volume, accumulated volume, hourly flow, average flow, Btu content, ambient temperature, percent rated engine speed (each station), number of engines on line (each station), set point (each station) and computed sums of volume and

FIGURE 11—Station control equipment.

FIGURE 12—Station monitor at control center after full sequence.

flow. Continuously updated visual displays for each station giving suction and discharge pressure, set point, number engines out of service would be provided at Colorado Springs.

The completed system will scan the line and its 20 stations once every 4 minutes and will collect data on 160 variables. Logged data such as: Hourly flow, average flow rate, total hourly flow, total accumulated flow, etc., involves computation before it is logged. The automatic supervisory system will perform these computations. If necessary, the dispatcher can have updated dynamic conditions along the line logged out as frequently as once every 4 minutes. Under normal operation the data logger would printout, on demand, or at 15, 30 or 60-minute intervals.

The rapid data acquisition and high data density of this control system is compatible with high speed electronic computers. Planned for a later date, some of the functions a computer would perform are: Figuring input volume, keeping track of movements of line pack and Btu content; ordering adjustments of station-pressure set points to make the line pack available at sales outlets in the proper quantity, at the proper time and at minimum cost. The computer would also figure over-capacity requirements and notify the dispatcher when, and how much, the curtailments to interruptible customers would be.

Freed from the necessity of manual communication with the stations and constantly provided with updated information from points of control along the line, the dispatcher can make the decisions needed to provide his customers with the gas they need, when they need it.

Maximum utilization of equipment, using the automatic control systems, will result in reduced costs of gas transmission and in lower costs to the customer.

—The End

Pipe Line Pete's

IDEAS FOR THE FUTURE!

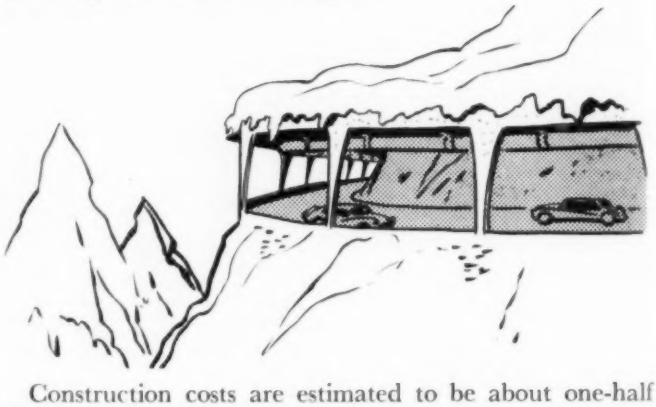
... in pipe line engineering, construction and operations

By Donald M. Taylor, Engineering Editor

Pipe Line and Double Decker Highway Across Alps

Here's an idea which might under certain circumstances be exploited in mountainous areas. Why not combine a pipe line project and a highway project to spread the cost of right-of-way easements, clearing and grading?

According to the *U. S. News and World Report* of April 25, serious study is being given to this idea developed by Italian road engineer, Eugenio Miozzi. The highway will be a two-story affair, the upper road being supported atop concrete stanchions with the pipe line clamped beneath it. The upper road will serve to protect the lower highway against snow drifts during winter when the bottom road will carry two-way traffic. When the thaw comes, the upper highway will be opened, and each road will carry one-way traffic.



Construction costs are estimated to be about one-half the normal mountain highway costs.

Interesting Discoveries in New Products

Thermo-Electric Generator

A five-watt thermo-electric generator that will operate continuously for a year on about $10 worth of LPG is priced at less than $500 by General Instrument Co While this is the first industrial thermo-electric generator on the market, it is by no means the first one to be used in the pipe line field. El Paso Natural Gas had three installations of the heat powered generators to provide cathodic protection for pipe lines in remote areas. The only trouble EPNG experienced was in the shorting out of the thermocouples.

Graphite Withstands 6,700° F

A purified graphite, Pyrographite, has been developed by the Raytheon Co., as an answer to high temperature requirements of space age industry. The secret of its ability to withstand the great heat is that it conducts heat along its surface 500 times more readily than through it.

New Molding Process

The Massachusetts Institute of Technology has developed a new wrinkle in casting that may save considerable money where the patterns are complex. Here's the way it works. Simply carve the pattern from expanded polystyrene, place the pattern in a container and pack sand around it. Then pour the molten metal into the plastic pattern. The high temperature metal vaporizes the plastic, and in a matter of seconds a high fidelity casting results.

Computer Writes Book

Bendix Aviation Corp., announced that one of its computers has written a book titled, "Angular Indexing Tables." Other computers have written music and translated magazine articles and books, according to this feature. At least one pipe line company is setting up to have a computer take over all operating chores,—dispatching, engine controls, sales and purchases, etc.

These gadgets are going to give us more leisure time to enjoy our stresses.

Perpetual Motion—Almost

The nearest approach to perpetual motion is a gyroscope which rotates in a vacuum, suspended by magnetic lines of force. This development by General Electric Co. will give us unprecedented accuracy in guidance systems according to the March 1960 issue of *Mechanical Engineering*. The gyroscope is suspended by lines of force repelled by an alloy which has been chilled to just a few degrees above absolute zero. At this low temperature, a current flowing in the metal will almost continue to infinity unless impeded by some outside influence. The metal acts as a magnetic insulator, and this is the way the gyroscope is suspended.

What Most People Don't Know About Tornadoes

Ask the average man to discribe a tornado, and chances are, he'll say, "It's a funnel-shaped black cloud with winds up to 600 miles per hour. The twist is counter-clockwise, and there's a vacuum in the center."

None of these things are necessarily true! We have had invisible tornadoes, and in Utah there was a snow-white one. So far, as the funnel shape is concerned, the most destructive tornadoes have been too close to the earth for a funnel to form.

The world's most destructive tornado—the great Tri-States Tornado—that traveled 219 miles in three hours and claimed 689 lives, was described as a "black turbulent fog about one-mile wide." This storm did not skip and its ground speed was from 57 to 60 miles per hour.

The wind speeds in tornadoes approach 600 mph, but for the most part they range between 300 and 400 mph. Moreover, the center is not a vacuum, although on the rare occasions when it was recorded, the pressure was low.

Direction of about 35 percent of the twisters is clockwise, rather than counter clockwise.

Tornadoes form when a cold dry air mass from a westerly direction overruns warm moist air moving from the south or southwest. The warm air rises, and the moisture which condenses releases latent heat which adds to the energy of the storm. The upper cold air must not only be dry, it must have a lapse rate exceeding the saturated adiabatic rate of cooling.

What's the best thing to do if a tornado catches you away from a storm cellar? Try to get out of the path by moving at right angles to the storm; if there is no better shelter, do the same thing you would do under machine gun fire, get in a shallow ditch and lie flat.

Non-Lubricated Compressors Prove Satisfactory

The Arkansas Louisiana Gas Company has been using compressor and scavenging air cylinders with no liquid lubrication for several years. In place of the usual steel compressor cylinder rings and lube oil force fed into the cylinders, the company has been using Micarta rings and packing which has been impregnated with solid lubricant molybdenum disulfide.

This unusual practice has paid off. Cylinder wear has been averaging only 0.003 inches per 10,000 hours of operation. One field compressor installation in severe service showed only 0.0015 inches wear after 8,000 hours operation. The venture has been so successful that Arkansas Louisiana now has over 100 non-lubricated cylinders in operation.

Molybdenum disulfide, which chemically is MoS_2, is a laminar type solid somewhat similar to graphite, mica and boron nitride which along with soft metals have been used in bearings for years. MoS_2 lubricating qualities have long been known, but it became commercially available only in 1948.

MoS_2 has a low coefficient of friction and tends to adhere to wear surfaces. It will withstand temperatures up to 600° F without oxidation and is generally inert and non volatile.

The rings and packing used by Arkansas Louisiana have been manufactured from materials which have been impregnated with MoS_2. Cost of the basic material runs only 20 to 25 percent higher than standard Micarta.

The big disadvantage of conventional lubricated compressor cylinders are that the lube oil sometimes ends up in dehydrator beds, and in pipe lines—where it causes a loss of efficiency. Moreover, the lubricators and lubricants cost money and require maintenance.

The company first tried liquid MoS_2 in compressor lubricators for break-in four-years ago and found that the packing ran much cooler than normal. After this, one compressor cylinder was equipped with the new rings and packing. During break-in, the lubricator pumps were operated several hours and shut off. Later inspection showed less wear on the MoS_2 lubricated cylinder than on the adjacent oil lubricated ones. The molybdenum disulfide impregnated products were then tried on main line compressors with excellent results.

With over 100 cylinders in operation, Arkansas Louisiana has experienced only three failures. All three were caused by abrasives in the line. The solid lubricant impregnated packing rings have not in all cases given as good service as the compressor piston rings. In some cases there has been more blow-by and quicker failure than with lubricated packing. However, the overall results have been good. The company is now trying cast iron rings coated with MoS_2 for packing.

Cylinder wear has been dramatically less with the Micarta Moly rings.

Most new non-lubricated rings and packing have been put into operation with lubrication for a few hours of break-in. However, four new 660 hp units each having four-compressor cylinders were placed in operation without hooking up the lubricators with excellent results.

From a paper presented at the 1960 AGA Conference in New Orleans May 10th. The title, "Non-Lubricated Compressors" by P. J. Chandler.

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Engineering Design —76—Properties of Electromagnetic Waves

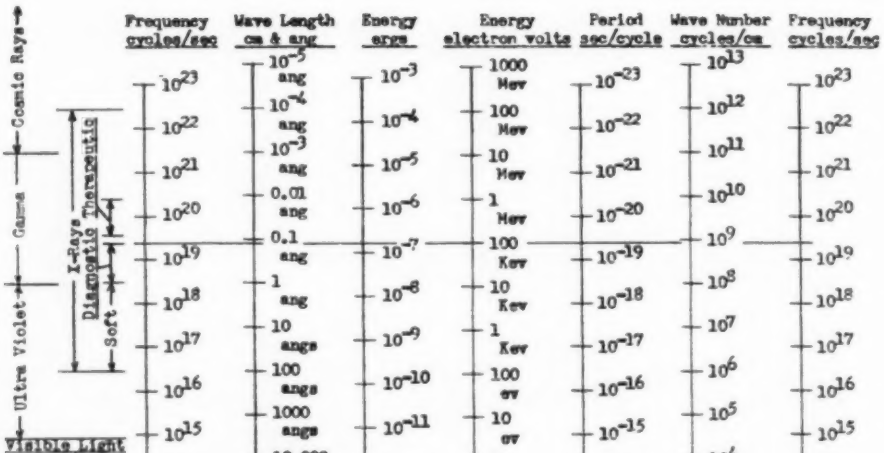


FIGURE 1

There is a relation between electromagnetic waves. The electromagnetic spectrum, shown in the accompanying figures, is divided by wave lengths and by methods used to produce the radiation. In most cases the boundary lines are not rigid; they are arbitrary. The regions of the spectrum with their limits and examples of methods of production are as follows:

1. Electric waves—approximately 0 to 10^4 cycles per second (frequency).
   Radiations from power lines.

2. Induction heating—approximately 0 to 4×10^7 cycles per second.
   Heat from eddy currents induced by field surrounding electric coil.

3. Radio, television, radar—10^4 to 10^{11} cycles per second.
   Transmissions from oscillating circuits. The following ranges are given by the Federal Communications Commission:
   AM Radio—550 to 1600 kilocycles.
   FM Radio—88 to 108 megacycles.
   VHF Television—low band 54 to 88 megacycles; high band 174 to 216 mc.
   UHF Television—470 to 890 megacycles.

4. Infrared—10^{11} to 4×10^{14} cycles per second.
   Produced by atomic or molecular excitation as radiation from hot bodies.

5. Visible light—wave length is 4000 to 7700 angstroms.

$$\left(\text{Angstrom is } \frac{1 \text{ cm.}}{100{,}000{,}000}\right)$$

   Produced by atomic or molecular excitation and also by sub-atomic electron transitions.

6. Ultra violet—1 to 4000 angstroms.
   Produced by electronic excitations as occur when an electric current passes through a gas.

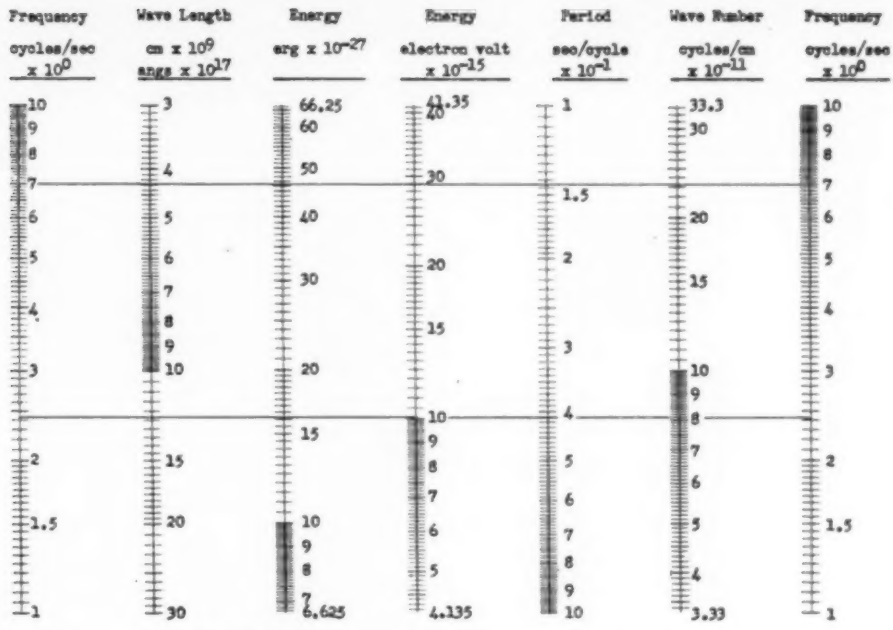


FIGURE 2—Properties of Electromagnetic Waves

7. X-ray—10^{-4} to 100 angstroms.
   Emitted from a target bombarded by high speed electrons. X-rays may be further classified as follows:
   Soft (low energy)—1 to 100 angstroms.
   Diagnostic—0.12 to 1 angstrom.
   Therapeutic—0.012 to 0.08 angstrom.

8. Gamma ray—10^{-3} to 1 angstrom.
   Emitted by radioactive nuclei.

9. Cosmic ray—unknown to 10^{-3} angstrom.
   Secondary cosmic rays are produced by bombardment of nuclei by primary cosmic particles which exist in outer space.

All electromagnetic waves travel with the speed of 3×10^{10} centimeters per second in a vacuum, commonly known as the speed of light and designated by the letter "c." The frequency of a wave, ν, is the number of vibrations or cycles per second. The wave length, λ, is derived from frequency and velocity as follows:

$$\lambda = \frac{c}{\nu}$$

The energy of a photon or quantum of electromagnetic radiation is given by:

$$E = h\nu$$

where "h" is Planck's constant, 6.625×10^{-27} erg-second, and "E" is determined in ergs. The electron volt is an energy unit equivalent to the work done when one electron is accelerated in a field of one volt potential difference. The electron volt is equal to 1.602×10^{-12} erg.

The period, τ, is the time of one cycle and is therefore the reciprocal of the frequency. Similarly, wave number, $\tilde{\nu}$, is the number of waves per unit length and is the reciprocal of wave length.

Given one property of an electromagnetic wave, other properties can be determined with respect to order of magnitude by using Figure 1. A straight line if drawn perpendicular to the scales, with the two frequency scales serving to keep the line perpendicular. If the wave is not defined, the spectrum scale will help determine the type of radiation. If the wave intersects the spectrum scale so that two definitions of type are possible, the correct definition is determined from the knowledge of how the radiation is produced.

Figure 2 provides more accurate values for the properties. Again, a straight line is drawn perpendicular to the scales using the two end frequency scales as guides. The proper logarithmic decade is probably more easily obtained from Figure 1.

CORRECTION

One of our subscribers called our attention to an error in Rules of Thumb. On Page 61, September 1957 we published, "A Head Loss Chart for Eight-Inch Pipe." A cypher was missing from all of the figures at the left of the chart giving "Throughput in BPH." Instead of reading 10, 20 . . . 100, 200, 300 . . . 1000, the figures should read, 100, 200 . . . 1000, 2000, 3000 . . . 10,000, barrels per hour.

This error was reprinted in "Pipe Line Engineering Design Manual," First Edition—1958 on Page 26 and in "Pipe Line Engineering Notebook" 2nd Edition—1959, Page 31. To readers saving and keeping up to date these notebooks, we suggest pen and ink corrections to these charts.

—The Editors.

EXAMPLE 1. Determine the energy and wave length of a radio wave of 700 kilocycles frequency (7×10^5 cycles).

Draw a straight line across Figure 1 at approximately 7×10^5 cycles per second on the frequency scale. The wave length is between 100 meters and 1 kilometer. Energy is between 10^{-20} and 10^{-21} ergs and between 10^{-6} and 10^{-7} electron volt.

Draw a second straight line across Figure 2 at 7 on the frequency scale. The line intersects the wave length scale at 4.29. The wave length is therefore 4.29×10^2 meters (429 meters). The energy scales are intersected at 46.4 ergs and 28.9 electron volts. The proper energy values are therefore 4.64×10^{-21} erg and 2.89×10^{-7} electron volt.

EXAMPLE 2. Determine the frequency of a wave of 100 kiloelectron volts energy. What type of radiation is the wave?

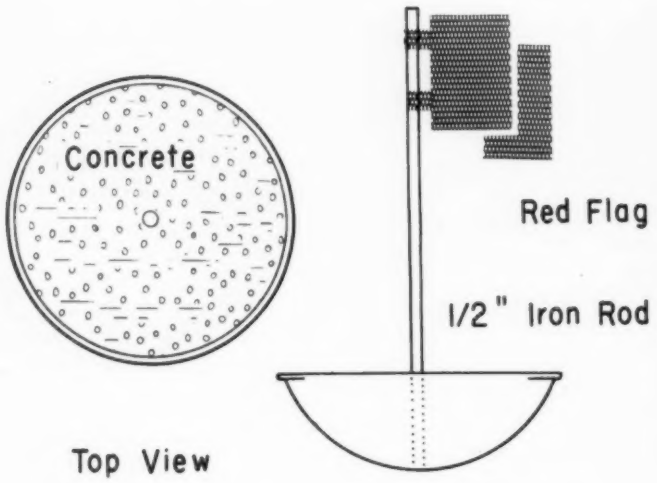
Draw a straight line across Figure 1 at 100 kev on the energy scale in electron volts. The frequency will lie between 10^{19} and 10^{20} cycles per second. The wave is an X-ray if it is emitted from a bombarded target, a Gamma ray if it emanates from a radioactive nucleus.

Draw a second straight line across Figure 2 at 100 kev. The intercept on the frequency scale is 2.42, and the frequency is therefore 2.42×10^{19} cycles per second. Note that 100 kev on Figure 2 is taken as the point "10" on the energy scale in electron volts.

How to do it

PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texas



Spare Hub Caps Make Good Base For Red Flag Markers

This editing puts you in one spot after another. Take this hint for example. It came to us from a bona fide pipeliner with long experience in selling us hints for this feature. After all us editors read it, we concluded, "H-m-m-m-m. Seems like a good use for hubcaps. Pay the man his 10 bucks."

But, after the check was in the mail, we started wondering. Where did our correspondent get his hubcaps to make flag stands? After all these things cost about $11 apiece up! Has he been raiding cars at night?

Oh, well. If you *happen* to "find" a few spare hub caps and need to erect a few red flags, fill them with concrete, stick a half-inch rod upright as shown and attach the flag.

But please don't embark on a life of crime to save money.

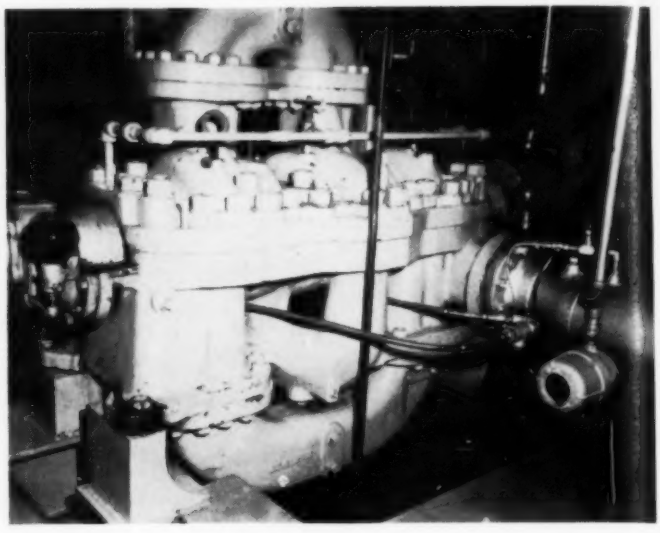
Truck Tractor Changed To Dual-Purpose Vehicle

Mount a stubby, heavy-duty tripod over the fifth wheel on a truck tractor and change it into a dual-purpose vehicle. With the demountable tripod off the tractor, the fifth wheel (on the tractor—not the float) is ready to latch onto a trailer or float.

Bolt the tripod with the sheave on top, onto the chasis of the tractor, and it is ready to perform any of the usual tasks allotted to a winch truck.

The tripod is made of 2-inch and 4-inch pipe as shown. The I-beam and pipe skid base is designed for ease in mounting.

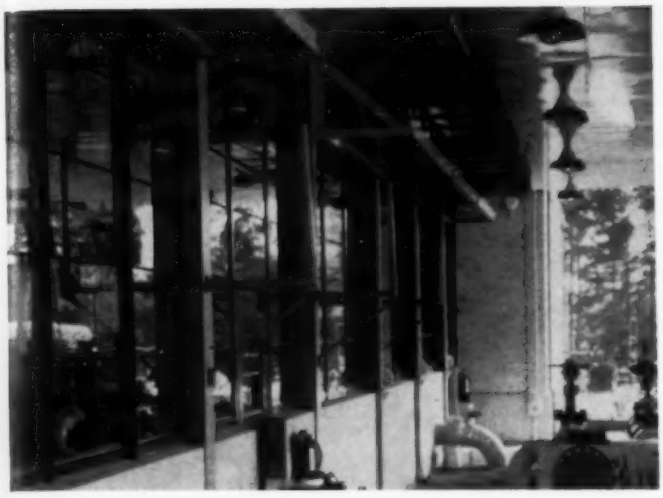
In use, the tripod can be hauled on a float or pipe trailer. When the destination is reached, the trailer is unhitched, the tripod sucked up onto the bed, pinned securely, and the very truck that hauled the pipe or other materials is ready to unload them.



Float Switch Shuts Down Remote Pump When Seals Leak

On remotely controlled pump stations, one of the difficult problems is how to warn the control station of leakage in the seals. One operator solved this problem by piping all drains and tell tales to a small pot with a float switch in it. Thus when leakage occurs, the pot fills up, actuates the switch to shut down the pump, signal the control station, etc.

The hookup is simple. The pot is mounted under the suction and all incoming lines gravity into it. A bleeder was installed so it could be tested regularly.



Safer Brackets for Window Cleaning Eliminate Hazard

The usual step-ladder for reaching those station windows too high for washing from the ground is at best a makeshift; often it presents an unnecessary hazard to station personnel.

For safer cleaning, one pipe line bolts a pair of brackets to each of the steel frame members supporting station window banks; brackets are positioned to take a light member, fabricated from 1½-inch pipe.

This unit consists of a horizontal support, one end of which is drilled to take a pin through the ears of the upper bracket on the window frame; the other end carries an upright stanchion, welded at right angles to the horizontal leg. The outer end has a diagonal brace which may be pinned to the lower bracket on the window frame. This whole unit forms a sturdy support on which may be laid scaffolding. The upright member has a loop at its top, through which may be passed a light chain as a "life line."

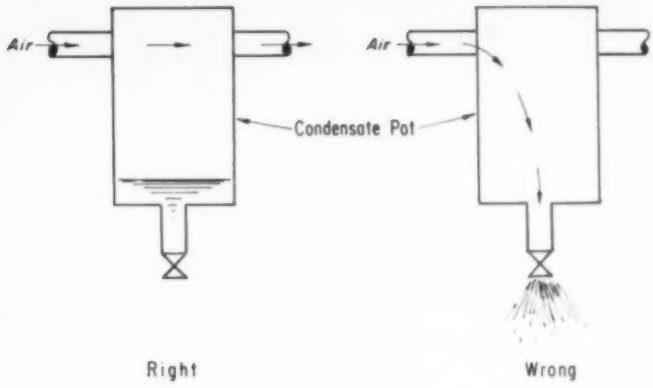
On a wide expanse of windows it is not necessary to have enough pipe supporting members to cover the entire station, brackets permit easy removal so the scaffold planks can be shifted to uncleaned windows.

Pipe and Chain Make Simple Pipe Bending Rig

This beats the so-called "track-jack" method all to heck—for the simple reason that it's safer. Just monkey around with the track-jacks and let somebody forget to take the handle out when the jack is in a strain, and you may end up shedding teeth, jaw bones and a few miscellaneous parts of your anatomy.

For light bending, simply cut a bending shoe from pipe to fit the outside diameter of the pipe to be bent. Cut a strut from proper size pipe and tie a chain across the strut as shown. Then connect your come-along (or coffin-hoist) and bend the pipe.

If you are really serious about bending pipe—meaning that you plan to repeat this operation a number of times —you'd better fabricate some clamps to go on the end of the chain and do the job up brown.



Compressed Air Leaks Cost More Than You Think

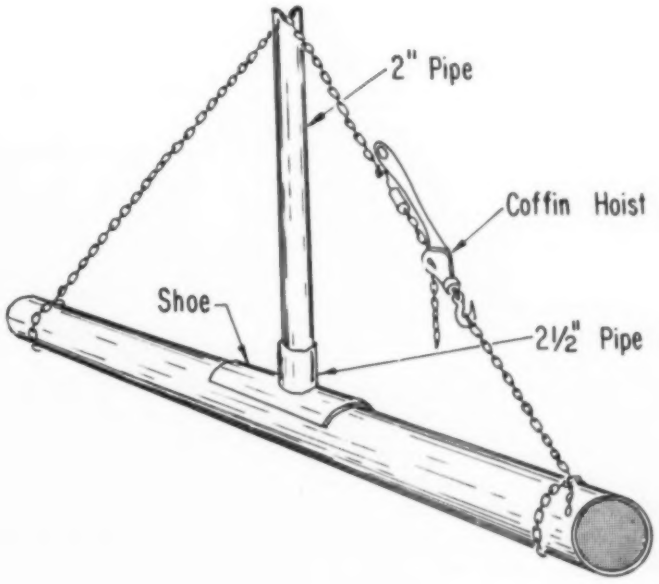
When you hear the hiss of leaking compressed air, you'd better start thinking of a remedy, because translated into dollars and cents that hiss could amount to a considerable clank of the change or a heavy rustle of the green.

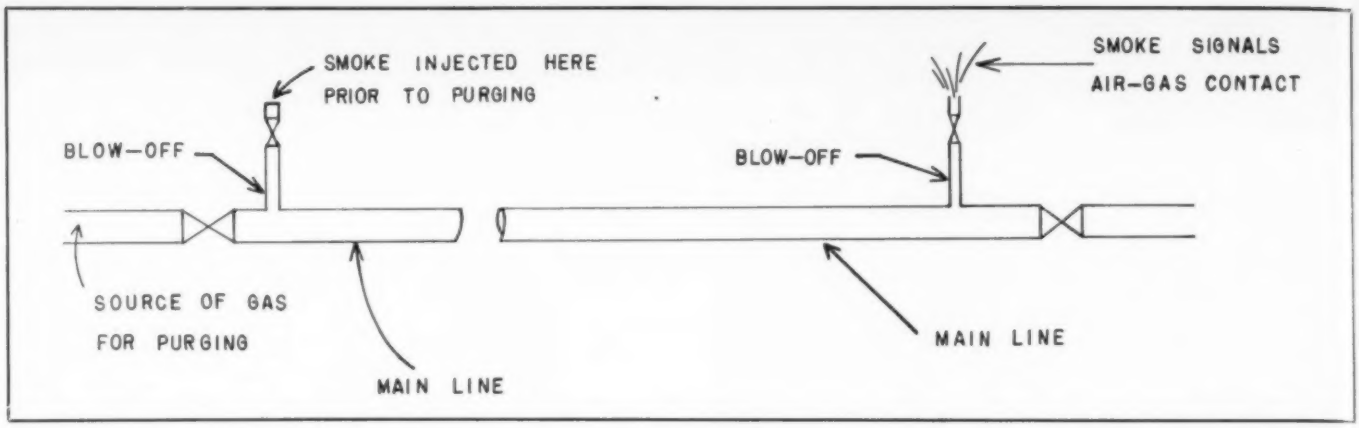
Just take a look at the table below which was compiled for us by one of our readers:

WHAT COMPRESSED AIR LEAKS COST
ON A 30 DAY BASIS

Leak size inches	Cu. ft. Wasted in 30 days at 100 psi	Total Cost of Air Wasted in 30 days at 10¢/100 cu. ft.
1/32	69,552	$ 6.92
1/16	278,640	27.86
⅛	1,114,560	111.46
¼	4,449,600	444.96

A wasteful practice fairly common in the pipe line industry is the thorough blowing of condensate legs and pots. The water should be drained off, but any attempt to blow the leg dry is useless and wasteful.





Smoke Signal Saves Gas When Purging Lines

By marking the gas-air contact with dense white smoke, El Paso Natural cuts down on waste of gas in purging

By Clinton McClure
Senior Engineer
El Paso Natural Gas Co., El Paso

El Paso Natural Gas Co. has cut down on the amount of gas that could be wasted in purging prior to commencing operations by slugging the air-gas contact with a dense white smoke. This smoke is blown into the upstream blow-off prior to opening gas into the section to be purged. An observer posted at the downstream blow-off simply watches for the smoke, and when it shows up (or a short while later) signals for the purge gas to be shut off.

In the past, an excess amount of gas has been used as a safety measure in purging pipe lines of air. There have been cases on record where systems commenced operations with air in the line with disastrous results.

Various methods have been used in pipe line purging.

Eyeball—Or Experience Method. This is the most common practice. A large amount of gas is blown through the pipe line until the pressure drop through the downstream blow-off is sufficient to cause water vapor "nodes" above the blow-off. Many pipeliners will stake their reputation on their ability to distinguish between the color of air "nodes" and gas "nodes." In most cases they are correct, and if they simply wait long enough and let enough gas be wasted, they can be right 100 percent of the time.

The nodes or cones which form above the blow-off are caused by the refrigeration effect of the expanding gas and the resulting condensation of water vapor from the entrained atmosphere. Gas being a better refrigerant than air might make the nodes appear whiter than that of air at the same pressure drop, but who knows what the pressure drop is during purging.

Gravity Method. Another method of detecting the optimum shutoff point for a purge is to fill the chamber of the pipe with inert gas. The gravity of the inert gas is different from that of natural gas. A gravity meter is used to check specific gravities until the gas shows up.

The gravity meter can be used without inert gas, but this is about as risky and expensive as the "experience" method.

Using Anhydrous Ammonia. Anhydrous ammonia was being used as a tracer in flow measurement studies, and in the search for a safe, sure, and inexpensive method of purging a pipe line, this was one of the methods tried.

Using a pick-up point at the downstream blow-off, a test solution of phenolphthalein solution for chemical detection was tried. This appeared to be the ideal solution where the pipe was clean and dry. But water inside the pipe will combine with the ammonia to form ammonium hydroxide making detection impossible. Another failure was caused by excess iron sulfide inside the pipe. In addition, the method, as it was used, required that an operator be positioned beneath the vibrating blow-off during the tests.

Smoke Method. Several years of looking for a colored gas or smoke that was not toxic or corrosive ended with the mine smoke which is now being used for purging as follows. A DC motor driven blower is attached to a sheet metal flume which is placed on top of the upstream blow-off. A smoke candle is placed in a filtered pipe capsule attached to the side of the flume. Before placing the flume over the blow-off, the candle fuse is lit, the safety cap screwed on and the blower is started. The smoke from the candle is emitted to the flume and the blower forces it into the blow-off. If too much suction is present at the injection point, the downstream blow-off should be closed during injection.

The downstream blow-off may be observed from a convenient distance during the purge, as the smoke can be seen for some distance when it arrives. After the smoke has cleared for one minute, the blow-off can be closed for loading the line.

This method of pipe line purging is accurate and conserves the purge gas.

ACKNOWLEDGEMENT
Condensed from a paper presented at the 1960 American Gas Association, Operating Section Conference, May 13, 1960, New Orleans, La.

WHAT'S HAPPENING IN PIPE LINE CONSTRUCTION

By Donald G. DePugh, Construction Editor

FPC Examiner Approves Pacific Gas Application to Construct 614-Mile Line

The long-sought natural gas pipe line from Canada to San Francisco crossed another hurdle last month when a Federal Power Commission examiner approved the proposal of Pacific Gas Transmission Company to lay a 614-mile, 36-inch line through Idaho, Washington and Oregon.

The examiner conditionally authorized three companies to import 213.3 billion cubic feet of gas annually from Canada for consumption in the northern states and California.

The entire $400-million project includes a 450-mile, 36-inch line from Alberta to the Idaho-Canada border and a 900-mile line from Kingsgate, Idaho, to San Francisco. Alberta Gas Trunk Line and Alberta Natural Gas Company will lay the Canadian lines. Pacific Gas plans to build the interstate transmission line from Kingsgate to Malin, Ore., at a cost of about $133 million. Pacific Gas & Electric will lay the final 296 miles of 36-inch from Malin to Antioch, Calif., at a cost of approximately $82 million. Pacific Gas would import 418 MMcf daily for delivery to PG&E.

El Paso Natural Gas Company and Montana Power Company also were authorized to import Canadian gas. El Paso would receive the gas through Pacific Gas Transmission's line and deliver to the Spokane, Wash., area. El Paso would take 136 MMcf per day from Pacific Gas. Montana would import 50 MMcf of gas daily for delivery to Montana's general system.

The examiner's decision is subject to review by the commission. The authorization was made subject to "stringent conditions to protect consumer prices during the evolution of further Canadian regulation of producer and pipe line profits."

Great Northern Receives Approval from Commission

Great Northern Railway Co. has received approval from North Dakota Public Service Commission to construct its 110-mile crude line system in the state.

Size of line has not been determined. The $3½ million system will carry crude from Lignite and Newburg fields in Burke and Bottineau counties to the Minot terminal.

This is first phase of a planned system to the Twin Cities and Duluth-Superior areas.

Pentzien, Inc., Awarded Underwater Pipe Line Work

Pentzien Inc., has been awarded a contract by Texas Eastern Transmission Corporation for construction of a 20-inch Arkansas River crossing near Little Rock, Ark.

Also, Pentzien has been awarded a contract by Arkansas Industrial Pipe Line Corporation to lay a dual 18-inch Arkansas River crossing near Wright, Ark.

Atlantic Seaboard Corp. To Construct 20 Miles

The Federal Power Commission has authorized Atlantic Seaboard Corporation to construct 21 miles of 10 and 26-inch gas lines in Virginia and West Virginia. Atlantic will lay 13 miles, 26-inch, between Cleveland and Seneca, W. Va., 6.5 miles, 26-inch, near Strasburg, Va., and one-mile of 10-inch in Fairfax County, Va.

Northern Illinois Lets Contract on 73-Mile Line

Northern Illinois has let contract on a 73-mile, 30-inch natural gas line from Troy Grove to Aurora, Ill., to Contracting & Material Company. Construction is scheduled to begin immediately on the $10 million project.

Seadrift Awards Contract On 108-Mile Gas Main Line

Seadrift Pipeline Corporation has let contract to H & K Construction Company to build its 108-mile, 8-inch gas main line from Seadrift to Ella, Texas. The line will take gas from Humble Oil & Refining Company's King Ranch plant and serve Union Carbide's plant in Seadrift.

Four Spreads Working on Mid-America Pipe Line Co.

Williams Brothers Company has four spreads working on Mid-America Pipe Line Company's LPG line from Texas to Wisconsin and Minnesota.

Scheduled to start this month are spreads number 3 and 4. Spread 3 includes 300 miles of 8-inch from Conway, Kan., to Macon, Mo. The fourth spread consists of 6-miles of 8-inch and 290 miles, 6-inch from Macon, Mo., to Madison, Wis.

Spreads 1 and 2 are laying over 600 miles of 8 and 10-inch in Texas, Oklahoma and Kansas.

Michigan Wisconsin Lets Contracts On 92-Mile, 24-Inch Wisconsin Line

Michigan Wisconsin Pipe Line Company has let contracts on 92 miles of 24-inch main line from Appleton to Marshfield, Wis., to Houston Contracting Company.

This line will connect with the Midwestern Gas Transmission Company main line which will extend from the Canadian border to Marshfield.

Contracts were let on 110 miles of 4, 6, and 8-inch lateral lines in Wisconsin to Panama Williams Corp. and on 85 miles of 16-inch Marinette lateral to Hallmac Construction Co.

This work is scheduled to get under way this month. Michigan Wisconsin also has awarded contracts to R. H. Fulton & Company, Bechtel Corporation, Somerville Construction Company and Majestic Contractors International, on about 500 miles of 24 and 30-inch loop lines along its system between Texas and Michigan. Michigan Wisconsin is awaiting authorization from the Federal Power Commission before starting construction on these loops.

Several Major Applications Before FPC Would Cost Over $660 Million

Applications pending Federal Power Commission approval on major expansion programs for 1960 total over $660 million. Hearings on several of these projects are underway now.

Transcontinental Gas Pipe Line Corporation's $52 million proposal to construct 280 miles of 30 and 36-inch loops and add 32,040 compressor horsepower; Michigan Wisconsin Pipe Line Company's $49 million plan for 341 miles, 24-inch and 188 miles of 30-inch; and Texas Eastern Transmission Corporation's application on 212 miles of 20 to 36-inch lines, at a cost of $49 million, are being considered by the FPC presently.

Other significant proposals for 1960 include Tennessee Gas Pipeline Company's request to lay 191 miles of 30 and 36-inch loops, 72 miles, gathering lines and add 43,600 hp to cost about $46 million. Colorado Interstate Gas Company is seeking permission to construct about 500 miles of 26-to-34-inch main lines at a cost of $90 million. El Paso Natural Gas Company's $58 million 400-mile, 34-inch main line from Utah to California is under FPC study. Houston Texas Gas & Oil Corporation and Coastal Transmission Corporation have filed jointly an application for construction of about $18 million of new facilities.

To supply additional gas to the Chicago area, Natural Gas Pipeline Company hopes to get approval on its $31 million plan which includes construction of 151 miles of 36-inch and 180 miles of 24-inch lines. Pacific Gas Transmission has $133 million proposal for construction of 614 miles of 36-inch as the northern section of the Canada to California gas line. Peoples Gulf Coast Natural Gas Pipeline Company's $43 million application includes 371 miles of 30-inch loops.

Panhandle Eastern recently filed for permission to build 305 miles, 30-inch and 40 miles, 26-inch with addition of 43,000 hp at a cost of $60 million. Trunkline is awaiting approval on its $40 million expansion which consists of 252 miles of 30-inch and 140 miles of laterals.

Trunkline Begins Service To Consumers in Michigan

Trunkline Gas Company began service to Consumers Power Company last month through its newly constructed 204-mile, 24-inch main line extension from Tuscola, Ill., to the Michigan-Illinois border.

Deliveries of 100 MMcf per day will go to Michigan. Trunkline, which increased its capacity to 510 MMcf daily through an $82.5 million expansion program, is planning an additional $45 million looping project to boost the capacity to 710 MMcf of gas per day.

Luke R. Lamb Named FPC Assistant General Counsel

Luke R. Lamb has been named assistant general counsel of the Federal Power Commission. He had been a supervisory trial attorney on the FPC's legal staff since 1955, and succeeds W. Russell Gorman, who is resigning to go into private practice.

Lamb will be responsible for all natural gas rate matters in the Office of the General Counsel. He commenced his government work in 1935 with the Department of Treasury. Prior to joining the FPC staff, Lamb was a trial attorney in the Office of Price Stabilization and spent several years in general law practice in Washington, D. C.

Magnolia Plans 350-Mile Microwave System in Texas

Magnolia Pipe Line Company will install a 350-mile microwave communications system to connect central and western Texas.

Included in the project is 12 relay towers, and it will provide remote control of six pipe line pump stations. The network will make available voice communication between the company's storage terminal at Corsicana and its West Texas gathering terminal at Midland. Eventually, Midland will be the control point for the pump stations on the 235,000 bpd system. Three stations will be switched to automatic control in 1961; the other in 1962.

The new communication system will connect with a 260-mile, 11-tower system completed in 1959 from Corsicana and Beaumont.

Texas Pipe Line Awards Contract on 42-Mile Line

Texas Pipe Line Company has awarded a contract to M. L. (Jack) Moore Construction Company to lay a 42-mile products pipe line in east Texas.

The 6-inch line will extend from New Hope plant in Franklin County to the Nettleton station to connect to a main pipe line system.

Alberta Gas Lets Contract To Fulton Banister Ltd.

Alberta Gas Trunk Line Company Limited has let contract to Fulton Banister Ltd., to construct 72 miles of 24-inch gas main line from Torrington to Rimbet, Alta. Estimated cost of project is $6½ million.

Shell Awards Contract To Houston Construction

Houston Contracting Company has been awarded a contract by Shell Pipe Line Corporation to lay 9 miles of 10 and 22-inch crude lines across the proposed Oologah Reservoir in Rogers County, Oklahoma.

35-Mile Crude Line Planned in Chile

Construction is planned for a 35-mile crude line in Chile. It will transport crude from Delgada Este and Faro Este fields of the Punta Delgada area to a terminal at San Gregario.

Tennessee Gas to Lay 11-Mile Offshore Line

Tennessee Gas Transmission Company was authorized by the Federal Power Commission to construct an 11.6-mile, 12-inch gas line off the Louisiana Coast. The line will be laid in Block 17, East Cameron area.

Mannix Co. Ltd., Building 70-Mile Gathering System

Mannix Co. Ltd., is laying a 70-mile crude gathering system for Pembina Pipe Line Ltd. The 3 to 10-inch lines will be constructed in Alberta fields.

PROPOSED PIPE LINE CONSTRUCTION

Here in convenient summary form is Pipe Line Industry's listing of company, line size, length, service, location and project status.

U. S.

Algonquin Gas Transmission Co., Boston, 25 miles, 20-inch; 8 miles, 8-inch, gas, and 12,000 hp addition in Massachusetts. $6 million, before FPC.

Anchorage Gas Corp., Houston, 165 miles, 12-inch, gas, Kenai to Anchorage, Alaska, $15 million, planned.

Arkansas Industrial Pipeline Corp., Shreveport, 130 miles, 18-inch, gas, Perla-to-Helena, Ark., $9 million, planned.

Arkansas Louisiana Gas Company, Shreveport, La., 58 miles, 2-6-inch, gas, planned.

Belle Fourche Pipeline Co., Casper, Wyo., 103 miles, 8-inch, crude, Fiddler Creek field to Lance Creek, Wyo., and branch lines from North Donkey Creek field to Rozet and Miller Creek fields, $2¾ million, before Wyoming Public Service Commission.

Buckeye Pipe Line Co., New York, 54 miles, 16-22-inch, crude, main lines from Toledo to Trenton, and Detroit, Mich., $4 million, planned.

Carolina Pipeline Company, Columbia, S. C., 85 miles, 8-inch, gas, in South Carolina, $5 million, before FPC.

Coastal States Gas Producing Co., Corpus Christi, Texas, 60 miles, 10-inch, gas, gathering, La Salle and Frio counties, Texas, before FPC.

60 miles, small diameter, gas gathering line, to tie in with system under construction and extend to Pearsall County, Texas, planned.

25 miles, gas, Associated Gas & Oil Co. field to South-Tex Corp., processing plant west of Corpus Christi, Texas, planned.

37 miles, gas gathering in Brown, Eastland, Comanche and Erath counties, Texas, planned.

Coastal Transmission Corp., Houston, 81 miles, 3 to 10-inch, gas, laterals; 5,500 hp in stations at Port Lavaca, Texas, and Eunice, La., and additional 1,500 hp at Robstown, Texas, $6.2 million, before FPC.

Colorado Interstate Gas Co., Colorado Springs, 140 miles, 34-inch, gas, Green River, Wyo.-to-Provo, Utah; 109 miles, 26-inch, Texas Panhandle to southeastern Colo., 136 miles, 34-inch, southeastern Colorado-to-Pueblo, Colo.; 107 miles, 30-inch, Pueblo-to-Denver, $91 million, before FPC.

Colorado Oil & Gas Corp., Denver, 400-miles, gas, from Gubik field to Fairbanks, Alaska, planned.

Columbia Gulf Transmission Co., Houston, 12.8 miles, 6 and 20-inch, gas, loop line in Louisiana, $730,000, authorized.

Continental Pipe Line Co. (joint venture with Husky Oil Co.), Ponca City, Okla., 85 miles, 6-inch, products, Helena to Great Falls, Mont., planned.

East Coast Pipeline Co., 90 miles, 12- to 24-inch, products, Linden, N. J. to Suffolk County, N. Y., $25 million, planned.

El Paso Natural Gas Company, El Paso, 199 miles, 30-inch, Permian-San Juan crossover loop, before FPC.

17 miles, from Pacific Gas Transmission Co. facilities to near Spokane, Wash., before FPC.

34 miles, 20-inch, Puckett to Goldsmith, before FPC.

23 miles, 20-inch, Goldsmith to Eunice-Plains line, before FPC.

9 miles, 20-inch, Goldsmith-Plains loop, before FPC.

43,600 hp in new and existing stations in Texas, Oklahoma, New Mexico and Utah, before FPC.

400 miles, 34-inch, Salt Lake City, Utah, to California border, before FPC.

Equitable Gas Company, Pittsburgh, Penn., 31 miles, 16-inch, and 26 miles, 20-inch, in West Virginia and Pennsylvania, $5 million, before FPC.

12½-miles, 16-inch, paralleling existing system in Harrison and Marion counties, W. Va., authorized.

Farmers Union Central Exchange, St. Paul, Minn., 200 miles, 8-inch, products, Glendive, Mont. to Minot, N.D., planned.

Gillette Pipeline Co., Cheyenne, Wyo., 103 miles, crude, from Dead Horse Creek field to Casper, Wyo., planned.

Goliad Corp., Houston (Joint venture with **Union Oil Co. of Calif.**), 85 miles, LPG, Kaplan, La. to Baton Rouge, extraction plant at Kaplan and fractionation plant at Baton Rouge, $12 million, planned.

Great Lakes Pipe Line Co., 58 miles, 8-inch, products, from Grinnell to Waterloo, Iowa, contract let to Shamrock Construction Co.

Great Northern Railway, St. Paul., 110 miles, crude, fields in Burke and Bottineau counties to Minot, N. D., $3½ million, Public Service Commission authorization.

Gulf Resources, New York, 125 miles, gas, gathering system, from Lopena area in Zapata County to a point in La Salle County, Texas, planned.

Hope Natural Gas Co., Clarksburg, W. Va., 45 miles, gas, from West Virginia to Pittsburgh area, planned, 20 miles, 24-inch, gas, in Wertzel and Monongalia counties, W. Va., authorized.

Houston Texas Gas & Oil Corp., St. Petersburg, Fla., 199 miles, 2 to 6-inch, gas, laterals; 20,000 hp in five new stations; $12 million, before FPC.

Humble Pipe Line Company, Houston, 63 miles, 8-inch, crude, and gathering system Sacatosa field, Maverick County to Pearsall, Texas, planned.

Iron Ranges Natural Gas Co., 115 miles, gas, from Itasca and St. Louis counties along route of Mesabi range from Grand Rapids to Aurora, Minn., $5 million, FPC authorization.

60 miles from Duluth to Silver Bay, Minn., FPC authorization.

Kansas-Nebraska Natural Gas Co., 15 miles, 12-inch, gas, loops and 4,800 additional hp at new and existing stations, $1.5 million, FPC authorization.

Laclede Gas Co., St. Louis, 107 miles, 24-inch, gas, Hallsville to St. Louis, Mo., planned.

Manufacturers Light and Heat Company, Pittsburgh, 103 miles, 20-inch, gas, in Franklin, Adams, Fayette, Green, Fulton and Somerset counties, Pa., $7 million, FPC authorization.

Matador Pipe Line Corp., Denver 175 miles, crude, from Bottineau, Burke and Renville counties, N. D., to Cromer, Man., Canada, $4 million, proposed.

Michigan Wisconsin Pipe Line Co., Detroit, 92 miles, gas, main, Marshfield to Appleton, Wis., contract let to Houston Constructing Co.

66 miles, 30-inch, loops, Indiana, Illinois, and Michigan, authorized.

342 miles, 24-inch, gas, loops, Kansas, Missouri, Illinois, and Iowa, before FPC.

123 miles, 30-inch, loops, between Sandwich, Ill and Big Rapids, Mich., before FPC.

37 miles, 6 and 12-inch lateral loops in Wisconsin, before FPC.

29 miles, 30-inch, loops, Illinois, Indiana, and Michigan, 3,000 hp. station, Janesville, Wis., before FPC.

Two 2,000 hp units at Meade, Kansas; one 2,000 hp unit at Havensville, Kansas, before FPC.

Mid-America Pipeline Co., Tulsa, 2,000 miles, 6-10-inch, LPG, from Texas-New Mexico to St. Paul, Minn., and Milwaukee, Wis., areas, $71 million, contract let to **Williams Brothers Company.**

Midwestern Gas Transmission Co., Houston.

504 miles, 24-inch, gas, from Minnesota-Canada border near Winnipeg to Marshfield, Wis., $52 million, FPC authorization.

Mississippi River Fuel Corp., St. Louis 20 miles, 12-inch, 3 miles, 4-inch, gas, 2,500 hp station, to develop underground storage reservoir at St. Jacobs field in Madison and St. Clair counties, Ill., $3 million.

Mississippi River Transmission Corp., (subsidiary Mississippi River Fuel), 115 miles, 24-inch, gas, southeast Missouri to St. Louis County, planned.

Natural Gas Gathering Co., Inc., (joint venture with Gulf Resources, Inc.) gas gathering facilities in Zapata and Starr counties Texas, before FPC.

Natural Gas Pipeline Company, Chicago. 151 miles, 36-inch, gas, loops, between Ford County, Kansas and Joliet, Ill. and 180 miles, 24-inch, main, from Minneola, Kan. to Kiowa County, Okla., $31 million, before FPC.

New Haven Pipeline, Inc., products line. New Haven, Conn. to Springfield, Mass., $2.5 million, planned.

Northern Illinois Gas Co., Aurora, Ill., 75 miles, 30-inch, gas, from underground

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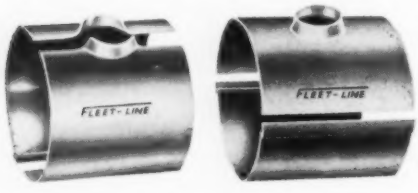

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storage at Troy Grove to LaGrange, Ill., $10 million, contract let to Contracting and Material Co.

Northern Natural Gas Company, Omaha. 171 miles, main line extensions, 66 miles, main loops, 139 miles, branch lines, 6,000 hp additions, to extend system from Minneapolis to Duluth-Superior area, $25.7 million, contracts let on 315 miles to Williams Bros. Co. and R. H. Fulton & Co.

46 miles, main line extensions, 191 miles, loops, 1,767 miles, branch lines, and 45,400 additional hp, in Iowa, Minnesota, South Dakota, Nebraska, Wisconsin and Illinois, $76.7 million, FPC authorization.

37 miles, 30-inch, Bushton compressor station to Otis field, Kansas, 7,000 additional hp at Bushton, and development of underground storage facilities at Otis field, $20 million, before FPC.

Ohio Fuel Gas Co., 59 miles, gas, 4-24-inch main lines, in Belmont, Carroll, Cuyahoga, Fairfield, Logan, Lorain, Marion, Muskingum, Stark and Wayne counties, Ohio, $5.1 million, planned.

Oklahoma Resources Development Co., Oklahoma City, 170 miles, 12-inch, gas, Oklahoma City to Harrah and Muskogee, Okla. and 130 miles, 4-12-inch lateral, planned.

Pacific Gas & Electric Co., San Francisco, 296 miles, 36-inch, gas, from Malin, Ore., to Antioch, Calif., southern section of line from Canada to California, $82 million before California Public Utilities Commission.

10 miles, 20-inch, Pittsburg to Walnut Creek, Calif. planned.

2.7 miles, 16-inch, Marin County, Calif., planned.

4.4 miles, 16-inch, Sonoma County, Calif. planned.

7.5 miles, 16-inch, south of Fresno, Calif. planned.

Pacific Gas Transmission Co., San Francisco, 614 miles, 36-inch, Kingsgate B.C. to Malin, Ore., northern section of Canada to California line, $133 million FPC Examiner Approval.

Panhandle Eastern Pipe Line Co., Kansas City, 305 miles, 30-inch, 40 miles, 26-inch, gas, loops, and 43,000 hp, and gathering facilities, $60 million, before FCP.

Peoples Gas Light & Coke, Chicago, 29 miles, 36-inch, gas between North Shore and Calumet stations, planned.

Peoples Gulf Coast Natural Gas Pipeline Co., Chicago. 371 miles, 30-inch, loops, and 45 miles, gas laterals, 6,700 hp in Victoria County, Texas, $43.5 million, before FPC.

Rio Gas Gathering Co., San Antonio, 97 miles, 3 to 8-inch, gas gathering, South Texas, to supply gas to El Paso Natural Gas Company, planned.

Rocky Mountain Natural Gas Company, 65 miles, gas, southwestern Colorado to serve Delta, Orchard City and Montrose, Colo., planned.

Seadrift Pipeline Corporation, 108 miles, gas, main, from Union Carbide's plant at Seadrift to Humble Oil & Refining Company's King Ranch gas plant, contract let to H & K Construction Co.

Southern California and Southern Counties Gas Cos., Los Angeles, 93 miles, 34-inch, California-Nevada border to Newberry, Calif., approved.

Standard Oil Company of California, 22 miles, 8-inch, crude, Kenai Peninsula to Nikiski, Alaska, $4 million, considered.

St. Lawrence Gas Company, Inc., Ogdensburg, N. Y., 75 miles, gas, main, United States-Canadian border to Ogdensburg, N. Y., $3.4 million, FPC examiner approval.

Tennessee Gas Pipeline Co., Houston 191 miles, 30 and 36-inch loops, in Ohio, Pennsylvania and New York, 72 miles of gathering lines and 43,600 hp in five stations, $46 million before FPC.

158 miles, 36-inch, gas, loops in Mississippi and Louisiana, FPC authorization.

21 miles, 16-inch, 2 miles, 12-inch, gas, Louisiana coast, Vermilion blocks 46 and 64, $3 million, before FPC.

Texas Eastern Transmission Corp., Shreveport, La., 212 miles, 20 to 36-inch, gas, and 3,300 hp station, in Pennsylvania, New Jersey, New York and Mississippi, $46 million, before FPC.

90 miles, LPG, Lebanon to Lima, Ohio, planned.

350 miles, 24-inch, coal slurry, West Virginia to New York, considered.

Texas Pipe Line Company, Houston, 42 miles, 6-inch, LPG, Franklin County to Nettleton, Texas, contract let to M. L. Moore Construction Co.

Transcontinental Gas Pipe Line Corporation, Houston, 129 miles, 30 and 36-inch loops; 53 miles of laterals, and additional horsepower capacity, in Texas, Louisiana, Alabama, Georgia, North Carolina, Virginia, Pennsylvania and New Jersey, $53 million, FPC examiner approval.

211 miles, 36-inch, and 69 miles, 30-inch, loops and additional 32,040 hp, in Texas, Louisiana, Mississippi, Alabama, Georgia and South Carolina, $52 million, before FPC.

13 miles, 24-inch and 18 miles, 20-inch loops, Louisiana, FPC authorization. 14 miles, 16-inch laterals, 1-mile, 12-inch lateral, Louisiana, $2.1 million, FPC authorization.

29 miles, 20-inch, gas, and 2,500 hp, in South Texas to take gas from South Texas Natural Gas Gathering Co., $2.4 million, before FPC.

Transwestern Pipeline Company, Houston, pipe line facilities to cost $5.4 million to make available additional gas reserves for the line presently under construction, before FPC.

Trunkline Gas Company, Houston, 252 miles, 30-inch loops, and 140 miles, laterals, between Longville, La., and Tuscola, Ill., $45 million, before FPC.

Underground Storage & Exploration, Upper Darby, Penn., 394 miles, 12-inch LPG, from Moundsville, W. Va. to Newark, N. J., $9 million, approved.

95 miles, 6-8 inch, laterals to Mauch Chunk, Penn., and to Philadelphia, planned.

United Gas Pipe Line Co., Shreveport, La., 59 miles, 36-inch, gas, lateral between Bastian Bay field and Plaquemines Parish, La., before FPC.

Valley Gas Transmission, Inc., Houston, 55 miles, 3 to 8-inch, gas, gathering, in Hidalgo, Brooks, Starr and Jim Wells counties, Texas, $15 million, before FPC.

Cleveland 140 digs 38-mile Idaho gas extension

Massart Construction Company of Spokane, Wash. used a Cleveland 140 to dig a 38-mile gas line eastward from Moscow, Idaho to serve a new refractory at Boville, another brick plant at Deary and smaller users along the line. The Cleveland dug the line 40 inches deep for 4 and 6-inch pipe at a rate of better than 2 miles per day.

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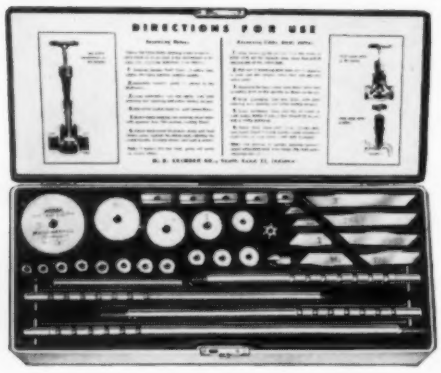

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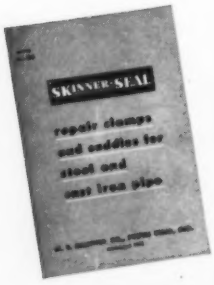

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ACT Oils, Ltd., Montreal, 400 miles, crude, Dawson Creek, B. C., to **Bella Coola, B. C., before B. C. government.**

Alberta Gas Trunk Line Company, 386 miles, 26-36-inch, gas, main, Berland River area, Alberta, to Alberta-British Columbia border; and 235 miles, 8-18-inch, gas, gathering, Alberta, $100 million, Alberta Oil and Gas Conservation Board, approved.

Alberta Natural Gas Company (Jointly owned by Westcoast Transmission Co. and Alberta & Southern Gas Co. Ltd.) 110 miles, 36-inch, gas, Alberta border to British Columbia-Idaho border, supply gas to Pacific Gas & Electric Co., $40 million, planned.

Arabian American Oil Company, New York, 63 miles, 30-inch, crude, from Khursaniyah station to Ras Tanura, planned.

Barnabos Group (Italian Interests), crude line from Venice, Italy, to Insbruck, Austria, with extension to Munich, Germany, planned.

Bituminous Oil Pipeline Co., Calgary, 250 miles, crude, from Athabasca tar sand plant in northeastern Alberta to Edmonton, approved.

Brazilian Government, Rio de Janeiro, 300 miles, 12-inch, crude, Rio de Janeiro to Belo Horizonte, planned.

British American Oil Co., Ltd., Toronto, 125 miles, gas, Pincher Creek fields to Calgary, Alta., before Alberta Public Utilities Board.

Burmah Oil Co., Ltd., 850 miles, crude, 20 inch, from Nahorkatiya to Calcutta, India.

Cartier Gas Corp. (St. Maurice Gas, Inc., and Consumers Gas Co., Toronto), 170 miles, gas, Montreal to Quebec City, planned.

Consolidated Gathering Systems, Ltd., Calgary, 198 miles, crude, Sturgeon field to Edmonton, planned.

Creole Petroleum Co., 44 miles, 12-30-inch, gas, Bachaquero to Tia Juana, Venezuela, planned.

Esso Standard Libya, 100 miles, 30-inch, crude, Zeltan oil field to Gulf of Sirte coast, planned.

Foothills Pipe Line, Ltd., 500 miles, 12 to 16-inch, LPG, from Alberta to Pacific Coast, $80 million, considered.

Foothills Pipe Lines Ltd., 1,300 miles, LPG, from Alberta-Saskatchewan border to Chicago, tie-in with Westalta Products Pipeline proposed system in Alberta, $100 million, before Alberta Board of Public Utilities Commissioners.

Gases Naturales de Colombia, S.A., 140-mile, 10-inch, gas, Cicuco field to Barranquilla, Colombia, planned.

Hydrocarbons Pipeline, Ltd., Winnipeg, Manitoba, 880 miles, 6-8 inch, products, from Edmonton to Winnipeg, $35 million, partial authorization.

Independent Pipe Line Co., 2,019 miles, 34-36-inch, crude, Edmonton to Montreal, 23,000 pump horsepower, $395 million, before Borden Commission.

Interprovincial Pipe Line Company, 350-mile extension from Toronto to Montreal, looping line from Edmonton to Toronto, crude, $240 million, considered.

Additional horsepower in four new stations and several existing stations, $9.3 million, planned.

Island Transmission Company Limited, Nanaimo, B.C., 25 miles, 10-inch, gas, from point near Vancouver, B.C. to Vancouver Island, 67 miles, 10-inch, laterals to Victoria and Nanaimo, B.C., $14 million, appeal before British Columbia Public Utilities Commission.

Magna Pipeline Co., 25 miles, 4-inch, gas, Vancouver, B.C. to Vancouver Island, $14 million, approved by Public Utilities Commission over Island Transmission Co. proposal.

Mid-Continent Pipe Lines, Ltd., 1500-mile, 30-inch crude, Edmonton to Chicago, planned.

Naphtha Israel Oil Co., 75 miles, 6-inch, gas, Rosh-Zohar field to Ashdod Yam on Mediterranean planned.

National Iranian Oil Co., 146 miles, 6 inch, crude, from Azna to Isfahan, Iran, $5 million, planned.

500 miles, 8-inch, products, Teheran to Meshed, Iran, contract let on 250 miles to Williams Bros. Co.

Northern Alberta Pipe Lines, Ltd., Edmonton, Alta., 110 miles, 10-inch, gas, main, Lac La Biche to Edmonton, $3 million, planned.

Peace River Oil Pipe Line Co., Ltd., 70-mile, crude, Swan Hills to Iosegun Junction, approved.

230 miles, 8-inch, crude gathering, from fields in northeast British Columbia to Dawson Creek, B. C., and Grande Prairie, Alta., and to existing lines at Sturgeon Lake, $8.5 million, authorized.

Pembina Pipe Line, Ltd., Edmonton, 1,200 miles, LPG, from Alberta gas fields to eastern Canada, planned.

Petroleos Mexicanos, 4, 6 and 8-inch, products, Mexico City-Puebla to Cuernavaca, planned.

8-inch, products, and 12-inch, gas Torreon to Chihuahua, to be built in 1960.

360 mile, 12-inch, products, Minatitlan to Puebla and Mexico City, construction to start in 1960.

Products, Guadalajara to Tepic, planned.

Products, Aguascalientes to Zacatecas, planned.

6-inch, products, Guaymas to Ciudad Obregon, considered.

8-inch products, Guaymas to Hermosillo, considered.

8-inch, gas, Tierra Blanca to Veracruz, to be built in 1960.

14-inch, gas, Mexico City to Salamanca, construction to start in 1960.

Gas, Ciudad Carmen to Ciudad Pemex.

8-inch, crude Comalcalco to Minatitlan, to be built in 1960.

Crude, Minatitlan to Salina Cruz, contingent on proposed refinery on Pacific Coast.

149 miles, 10-inch, products, Ciudad Pemex to Minatitlan, planned.

181 miles, 4-inch, products, Mexico City to Salamanca, planned.

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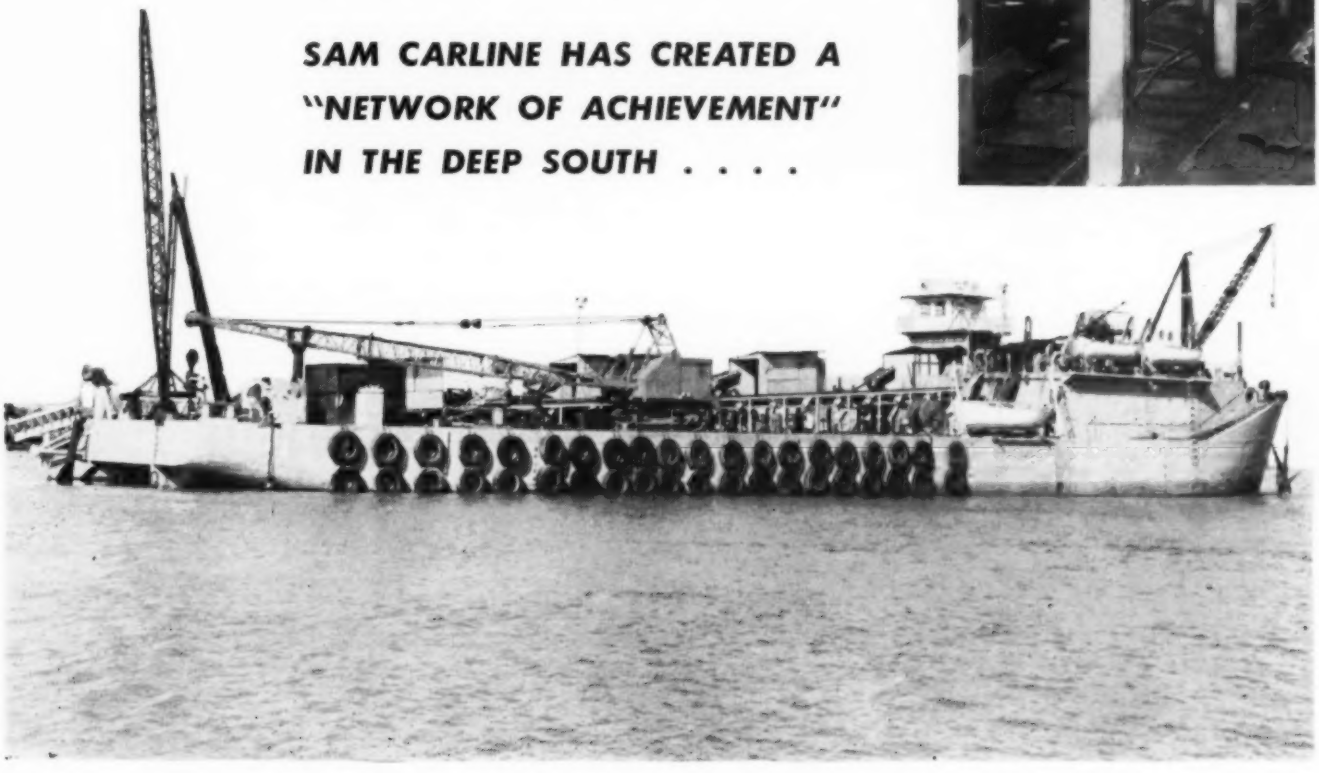

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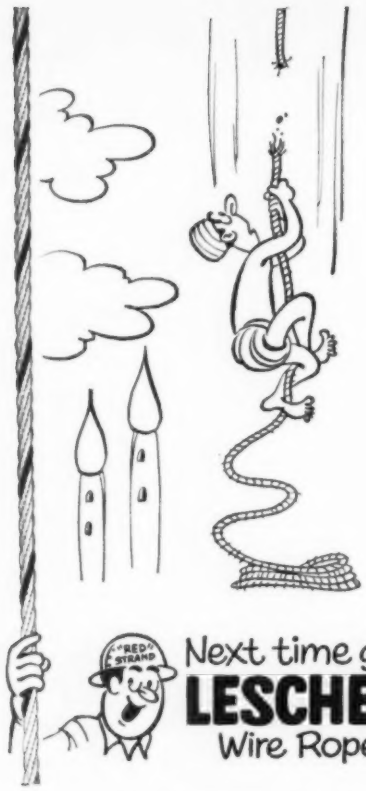

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Pipelines of Puerto Rico, Inc., 95 miles, 8-inch, products, Penuelas to San Juan, Puerto Rico, approved.

Quebec Gas Transmission Lines Inc., Montreal, 300 miles, gas, main, Quebec to Montreal, planned.

Rangeland Pipe Line Company Limited, 111 miles, 8-inch, crude, southeastern Alberta to Calgary, $3 million, planned.

Saskatchewan Power Corp., 179 miles, 4-6-8-inch, gas, planned.

Societa Nazionale Metanodotti, 650 miles, 18-inch, crude, Genoa, to Milan-Cremona-Torino, Italy, and Aigle, Switzerland, with extensions to Karlsruhe and Munich, Germany, planned.

Societe d'Etude du Pipe Line Sud-European, Paris, 419 miles, 30-inch, crude, port of Lavera to Strasbourg, with lateral extending 40 miles to Karlsruhe, Germany, approved by French cabinet.

Standard-Vacuum Oil Company, 60 miles, 8-inch, gas, main, in South Sumatra, considered.

Ste. d-Etudes de Pipeline Intercontinetaux, Paris, 1,400 miles, 30-40-inch, gas, from Hassi R'Mel field in central Algeria across Mediterranean, through Spain, France and into West Germany, considered, Fish International Corporation making engineering and feasibility studies.

Sui Gas Transmission Co., Multan, Punjab, India, 145 miles, 8-inch, gas, from Sylhet to Dacca, East Pakistan, $9 million, considered.

130 miles, 16-inch, gas, main line, Multan to Lyallpur, planned.

Syrian Pipeline, Damascus, 500 miles, crude, from Karshuk field, Syria to Mediterranean, planned.

300 miles, products, from Homs to tank farms in Damascus, Aleppo, and Latakia, planned.

Trans-Canada Pipe Lines Limited, Toronto, 50-mile, 30-inch, gas, lateral, Winnipeg to Emerson, Manitoba; 74 miles, 34-inch, loops, additional compressor hp at Swift Current, and Indian Head, Saskatchewan, and Portage la Prairie, Manitoba, $45 million, planned.

Trans-Prairie Pipelines, Ltd., Edmonton, crude line, from Weyburn field to Regina-Moose Jaw areas, $5 million, considered.

Westalta Products Pipeline Ltd., 900 miles, LPG, from Northern Alberta to Saskatchewan border, to deliver hydrocarbons to Foothills Pipe Lines, $40 million, before Alberta Board of Public Utilities Commissioners.

Westcoast Transmission Company, Ltd., 250 miles, 30-inch, gas, Taylor to Fort Nelson, B. C., planned.

Williams-McWilliams Industries, Inc., New York, 441 miles, 6-inch, crude, Villa Montes, Bolivia to Villa Hayes, Paraguay, considered.

Yacimientos Petroliferos Fiscales, Buenos Aires, Argentina, 621 miles, 12-inch, products, Mendoza to San Lorenzo, Argentina, $19 million, planned.

450 miles, 16-inch, crude, from Neuquen Province to Bahia Blanca, planned.

Yacimientos Petroliferos Fiscales Bolivianos, La Paz, 407 miles, 12-inch, crude, Camiri to Sica Sica, planned.

ON THE LINE

A Safety Break?

The National Safety Council is now recommending a safety break instead of a coffee break, in order to allow the foreman to get his men together for short safety meetings.

Recommendation calls for foreman giving safety talks once a week, making them a part of the company's safety program. This also would give men steady safety training from their own foreman. Council says that whether break is called a safety break, toolbox meeting or a tailboard meeting, planned safety talks by foremen will pay off. Anyone desiring National Safety Council books of five minute talks contact the Council at 425 N. Michigan Ave., Chicago 11, Ill.

Hope we can drink our coffee while listening to these safety talks!

Predicts Large Spendings

Construction outlays for gas facilities will be doubled by nearly 50 percent during the sixties, according to the American Gas Association.

Construction expenditures in the fifties totaled $14.2 billion; gas utility and pipe line construction budgets will amount to about $28.3 billion over the next ten years.

By 1970 distribution and transmission lines will amount to 878,000 miles as compared to present 596,000.

Speaking before the AGA annual convention in New Orleans, May 9, Wisterh Ligon, president of the Association singled out the operating engineers of pipe line and utility companies for their contributions to the industry's growth and progress in the fifties.

Humble Awards

Humble Oil & Refining Company's Coin-Your-Ideas program paid a total $43,250 to 866 employes for their work improvement suggestions and inventions in 1959.

Total of 1,666 ideas was submitted during the year; the greatest number in the program's 29-year history. Rate of acceptance was 43 percent of those submitted.

Communications by Stromberg-Carlson:

SYSTEM-WIDE DIALING FOR THE PIPELINE INDUSTRY

available on lease

The pace of today's business requires immediate communication all along the line. Complete, system-wide dialing of voice or data is the logical answer.

Stromberg-Carlson can supply **all** your needs with telephone and switching equipment designed by one of America's oldest telephone manufacturing companies and use-tested from coast to coast.

XY® Dial switching systems: standard of the independent telephone industry for quality and reliability.

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Complete details on our equipment lines and lease plan are available on request. In Atlanta call TRinity 5-7467; Chicago: STate 2-4235; Kansas City: HArrison 1-6618; Rochester: HUbbard 2-2200; San Francisco: OXford 7-3630; or write to Telecommunication Industrial Sales, 127 Carlson Rd., Rochester 3, New York.

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A DIVISION OF **GENERAL DYNAMICS**

Superior quality 12¾" O.D. J&L Electricweld line pipe was used for 17 miles of this Northern Oklahoma Gas Company line from Cherokee to Ponca City. The line will serve the towns of Ponca City, Perry and Newkirk, Oklahoma, and area industries. J&L line pipe is available in sizes from 6⅝" to 12¾".

General Contractor:
O. R. Burden Construction Corporation, Tulsa, Oklahoma
Contractor for coating and wrapping:
Secrest Pipe Coating Service, Tulsa, Oklahoma

Pipe laying operations with this J&L Electricweld line pipe are fast and efficient. Weldability is excellent. Pipe is 29.28 pounds per foot, .219" wall, X-46 grade.

Reliable field performance is assured because every length of J&L pipe undergoes a specified hydrostatic pressure test which proves its dependability under sustained and surge pressures.

This ultrasonic tester provides immediate pictures of weld soundness in all J&L Electricweld line pipe. It is one of the most advanced control devices in pipe-making.

Quality control at J&L pays off on a job at Cherokee

Every length of J&L line pipe passes over 50 quality tests before it enters the field

Total quality control of J&L Electricweld line pipe is maintained through more than 50 control measures and tests on every length of pipe.

Crush tests assure weld strength and steel quality. A modern ultrasonic device probes soundness of the weld. All joint ends are magnafluxed to assure freedom from flaws. Every length is full-pressure tested under specified A.P.I. or A.S.T.M. hydrostatic test requirements, both in time and degree of pressure. These are a few of the stringent controls that assure complete dependability of J&L Electricweld line pipe.

It pays to specify plant-tested, field-proved J&L Electricweld pipe for your transmission, distribution or gathering lines. Write for J&L's new builetin.

Jones & Laughlin Steel Corporation

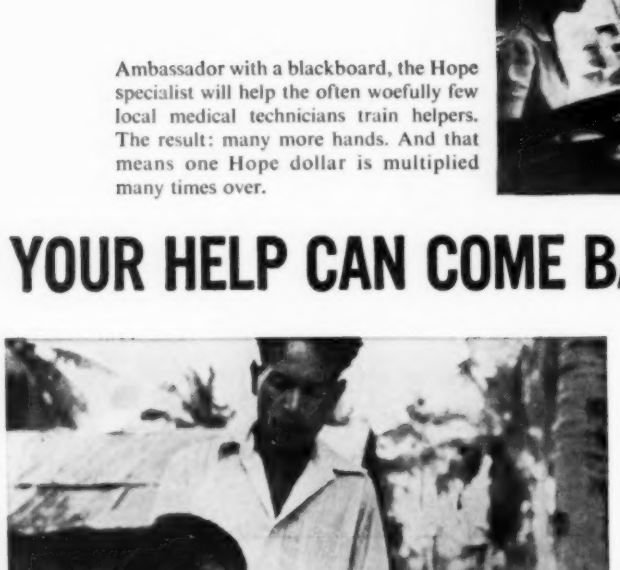
PITTSBURGH, PENNSYLVANIA

OFFICIAL UNITED STATES NAVY PHOTOGRAPH

This great seaborne health center will carry a new kind of aid abroad—*with your help.* Part of the people-to-people project Hope, it will enlist 200 specialists in sharing our health skills.

Ambassador with a blackboard, the Hope specialist will help the often woefully few local medical technicians train helpers. The result: many more hands. And that means one Hope dollar is multiplied many times over.

YOUR HELP CAN COME BACK A HUNDRED TIMES OVER



One local doctor for 100,000 people. These are the odds Hope may face. Yet Hope can mean so much. The health of this child. The health of five Indonesians. *Trained* hands and only a dollar's worth of penicillin can cure them of crippling yaws.

If enough of us help, the S.S. Hope will be outbound in 1960. First port of call: Indonesia. A bold health project called Hope will be underway.

The need is crucial. Many places, too many health hazards exist. Too many people robbed of the will to live. Too few hands to help. Often, a doctor for 100,000.

Hope's approach is *practical.* Help where a nation's doctors ask help. Help them help themselves to health. By training, upgrade skills—multiply hands. Hope's doctors, dentists, nurses, and technicians will man a center complete to 300-bed mobile unit and portable TV.

You can not only make every dollar do the work of many, you can earn a priceless dividend. With health comes self-respect. People at peace with themselves are less likely to war with others.

Hope is *yours* to give. It's a people-to-people project. For one year's worth, 3½ million Americans must give a dollar. Don't wait to be asked. Mail a dollar or more now to HOPE, Box 9808, Washington 15, D.C.

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What's Happening

among MEN in the INDUSTRY

C. E. Upson was elected president of the **Petroleum Industry Electrical Association** at its thirty-second annual meeting recently held in Kansas City, Mo. Upson is general superintendent of communications for **Natural Gas Pipeline Company of America.** Other officers elected include **E. B. Dunn, Atlantic Pipe Line Co., vice president,** and **Fred S. Jones, Platte Pipe Line Co.,** secretary-treasurer. Directors for the year are: **Delbert R. Wofford, Texas Gas Transmission Corporation,** chairman; **James Bowen, Mobil Oil Co.; C. D. Campbell, Houston Texas Gas & Oil Corporation,** and **L. E. Cook, Sinclair Pipe Line Co.**

C. E. Upson

MacKinley Rhodes, Tennessee Gas Transmission Company, was named general chairman of the 1961 convention to be held in Galveston April 11-13.

H. D. (Ike) Moore has been elected president of **Jayhawk Pipeline Corporation.** He recently became president of **Derby Refining Company Division of Colorado Oil and Gas Corporation.** Colorado and **National Cooperative Refinery Association** jointly own Jayhawk.

Moore had been with Service Oil Corporation and served as vice president and executive assistant to the president. Before joining Sinclair, he was an executive with Wood River Oil and Refining Company.

Thomas J. Donegan and **Paul A. Sweeney** have been appointed to the **Federal Power Commission** by President Eisenhower. Sweeney has been named to fill the position formerly held by Commissioner John B. Hussey, who died March 17.

Donegan will be appointed in place of **Commissioner William R. Connole.** Connole's term expires this June and Donegan is nominated for a five-year term ending June 1965. Sweeney will complete Hussey's term which extends to June 1963. Both appointments are subject to Senate confirmation.

Donegan (Independent) since 1957, has been a member of the Subversive Activities Control Board. He was graduated from Fordham University in 1931 with an LLB. From 1933 to 1946, he was a member of the Federal Bureau of Investigation and from 1947-1957, he was special assistant to the United States Attorney General. He also served as Chairman, Interdepartmental Committee on Internal Security, National Security Council in 1953-1954. From 1955-1957, he acted as Chairman, Personnel Security Advisory Committee, Executive Office of the President. He is a member of the American, N. Y. State Bar Associations, and Association of the Bar, City of New York.

Sweeney (Democrat) received his LLB from Georgetown University in 1921. From 1924-1927, he was an attorney, Department of Justice and in 1928, was an Examiner, Civil Service Commission. He served as Attorney, Department of State from 1928-1932, and since 1933, he has served in the Department of Justice. Presently he holds the position of First Assistant, Office of Legal Counsel, Department of Justice.

R. L. Staples has been named vice president, operations and member of the board of directors of **Kaneb Pipe Line Company.** Staples joined Pipe Line Technologists, Inc., in 1952 as project engineer in charge of construction on the original Kaneb products line. In 1953, he was named general manager of Kaneb. He will be headquartered at El Dorado, Kan.

Mid-America Pipeline Co. has announced the appointment of **David A. Roach** as vice president. Roach, a 14-year veteran in the industry, will be headquartered in Tulsa. He had been a vice president of the Phillips Pipeline Co. prior to joining Mid-America. Previously, he had been pipe line engineer and then chief engineer for Phillips. From 1941 to 1946, he served with the Army Corps of Engineers in Africa, India and Burma.

David A. Roach

Texas Gas Exploration Corporation has appointed **W. H. Woods** a vice president. Formerly a vice president of Runnels Gas Products Corporation, Woods also has worked in design and construction projects been associated with Union Oil and Gas Corporation and Gulf Oil Corporation. He has worked in design and construction projects such as submersible barges for marsh work and underground storage for propane and ethane.

Frank R. Markley, vice president in charge of transportation for **Sun Oil Company,** has retired after 40 years service with the company. He had been in charge of transportation since 1957. Previously, he had been vice president in charge of Marketing, the Department in which he began work in 1920. In 1948, he was named a director and in 1950, became vice president in charge of marketing.

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PIPELINE PROTECTIVE COVERINGS THAT LAST

Dale Te Kolste has been promoted to vice president and general manager of the Peoples Natural Gas Division of **Northern Natural Gas Company.** He will succeed **Donald L. Sedgwick** who retired.

Dale Te Kolste

Te Kolste joined Northern Natural in 1948 as right of way and claims agent. He was named to the legal staff in 1950, and named senior attorney in 1955. He was made administrative assistant in the Peoples division in 1958, and in 1959, was promoted to assistant general manager.

Sedgwick had been in the industry since 1919, and with Northern since 1951. In 1958 he was named general manager of Peoples division and elected a vice president of Northern.

Ransom M. Cook has been elected a member of the board of **Pacific Gas and Electric Company.** He is president and chief executive officer and a member of the board of directors of Wells Fargo Bank American Trust Company. He succeeds the late **Harris C. Kirk** as a director.

The A. F. Davis Silver Medal for 1959 will be awarded to two **Service Pipe Line Company** executives in recognition of their contributions to the advancement of industrial welding by the American Welding Society.

C. I. MacGuffie, president of the society, will make the presentation to **Art M. Hill,** superintendent of line maintenance, and **Fred W. Zilm,** contracting administrator, for Service Pipe Line. Hill and Zilm received the award on the merits of their paper published in the *Welding Journal* during 1959. The paper concerned "Maintenance Welding of High Test Line Pipe."

Peoples Gulf Coast Natural Gas Pipeline Co., has named **Jack E. Stoffregen** superintendent of its compressor station near Biggers, Ark. He succeeds **J. R. Buffington** who is on leave of absence. Stoffregen will be replaced by **James R. Ivey** as superintendent of affiliate **Natural Gas Pipeline Company of America's** station near Pampa, Texas.

James McGarrie has been named an assistant secretary and assistant treasurer of **Interstate Oil Pipe Line Company** and **Richard R. Brown** has been named to replace McGarrie as assistant comptroller. McGarrie joined **Standard Oil Company of New Jersey** in 1925, served in various positions in the treasurer's and comptroller's departments until 1946. Then he was transferred to Interstate as assistant to the comptroller. He became assistant comptroller of Interstate in 1947.

Brown joined the Pipe Line Department of Standard Oil Company of Louisiana, an Interstate predecessor, in 1935. He has served in various positions in the accounting field. He was named assistant section head of financial accounting in 1954, and became section head in 1959. Recently he has served as acting assistant comptroller of the company.

NEW! ANSCO SUPERPAK

for the first time, a new x-ray film packaging that saves time and lowers costs at no sacrifice in quality.

Interrupting operations to open small quantities of X-ray film? Handling many small packages and wrappings? Never again with Ansco SUPERPAK. New Ansco SUPERPAK® is the modern way to increase your efficiency through 600 non-interleaved sheet or 300 interleaved sheet packages of Superay 'A' or Superay 'B'.

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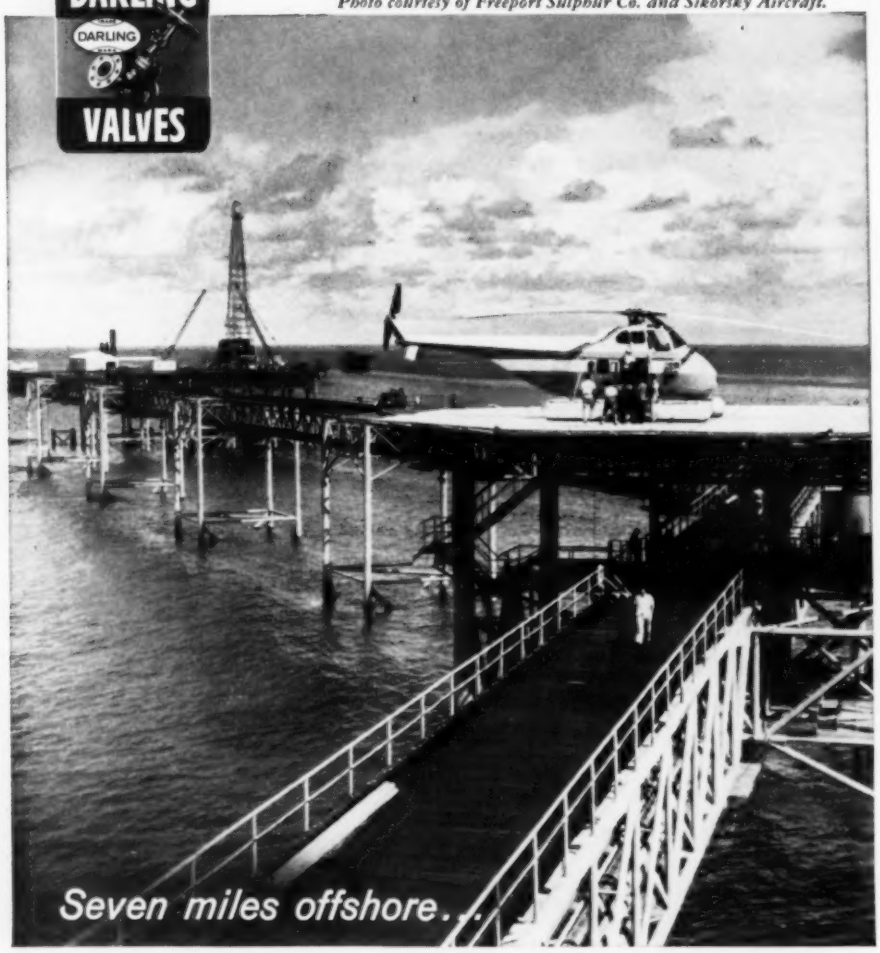
DARLING VALVES

Photo courtesy of Freeport Sulphur Co. and Sikorsky Aircraft.



90 DARLING VALVES

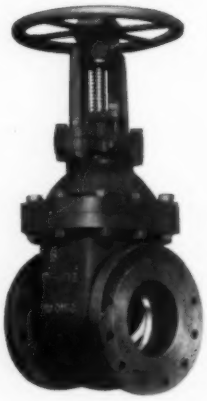
to help tap new sulphur deposit

Above you see part of Freeport Sulphur's $30,000,000 project to tap a major new sulphur deposit. It's the world's first offshore sulphur mining plant at Grand Isle...seven miles off the coast of Louisiana in the Gulf of Mexico.

Valves on the mile-long "steel island" mining plant were supplied by Darling. They include 2" to 12" OS and Y and 6" to 10" check valves made from Ni-Resist with monel trim ...all for use in corrosive service.

Here's another case where Darling's extensive research and development on corrosion-resistant valves helped solve a specialized operating problem. And on gate valves, Darling's *exclusive revolving double disc parallel seat feature* assures positive sealing and ease of operation at all times.

Let us assist *you* on applications where "just ordinary valves" won't do. Write or phone us about your valve requirements.



Darling OS and Y gate valve with flange ends . . . one of types being supplied for Freeport Sulphur's Grand Isle sulphur mining plant.

DARLING VALVE & MANUFACTURING CO.

Williamsport 27, Pennsylvania

Manufactured in Canada by Sandilands Valve Manufacturing Co., Limited, Galt 19, Ontario

Three engineers in the **Service Pipe Line Company's** West Texas division and district offices have been promoted. **Robert H. Grimes, Jr.,** former oil traffic engineer at Lubbock, Texas, becomes engineer, senior grade. **Merlin T. Bender,** former engineer in the Lovington, N. M., District replaces Grimes at Lubbock. **Dale Burton,** former junior engineer, succeeds Bender at Lovington.

Grimes replaces **C. F. Simes,** who was promoted to district superintendent at Lovington, N. M. Joining the company in 1948 as junior engineer, Grimes was named to his recent post at Lubbock in 1959. Bender joined the company in 1951 and was promoted to engineer at Lovington in 1953. Burton has been with Service since 1958.

James A. Wilson, 30-year veteran in the natural gas industry, was elected president of the **Southern Gas Association** at its 52nd annual meeting held in Galveston April 25-27.

James A. Wilson

Wilson, vice president of the Texas Distribution Division of **United Gas Corporation,** served as vice president for two years and succeeds **Oliver W. Clark, Southern Natural Gas Company.**

H. A. Eddins, Oklahoma Natural Gas Company, was elected first vice president; **C. L. Nairne, New Orleans Public Service, Inc.** was named second vice president; and **Frank Barragan, Jr., South Atlantic Gas Co.** was re-elected secretary.

Phillips Petroleum Company and **Phillips Pipeline Company** announce the promotions of **D. W. Calvert** and **C. G. Goss.** Calvert was appointed administrative assistant to the manager of the petroleum company's Supply and Transportation Department, and Goss became chief engineer for the pipe line company.

Calvert, who joined the company in 1952, has been senior design and construction engineer since 1955. Goss started with Phillips in 1948, and has been a senior design and construction engineer since 1953.

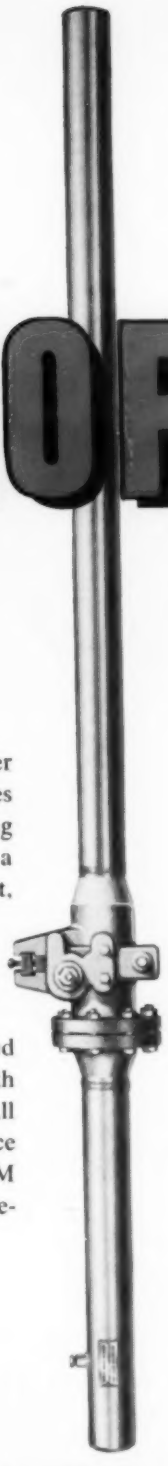
South Saskatchewan Pipe Line Company named three **Magnolia Pipe Line Company** executives directors of the Canadian company. **L. H. True,** Magnolia president, and **Ross Madole,** general attorney, were named vice presidents and directors. **E. J. Wacker, Jr.,** a vice president of Magnolia, was named a director.

The South Saskatchewan company is partially owned by **Mobil Oil of Canada, Ltd.**

Paul M. Crandall has been named vice president of **La Gloria Oil and Gas Company** and assistant to senior vice president in charge of the Oil Division of Texas Eastern Transmission Corporation. He has served as comptroller of La Gloria since 1958. His activities will include analyzing proposed property acquisitions, directing specialized accounting functions including budgets and making special financial forecasts and reports.

JUNIOR

flangnek meter tubes



The Daniel Junior flangnek meter tube provides operating advantages not found in simple, plate holding devices. The Junior fitting has a rack and pinion mechanism for fast, safe plate changing. Once the line is depressured a few turns of the speed wrench raises the plate clear of the fitting. Upstream tubes are factory-aligned with the fitting to form a smooth approach to the orifice plate. All specifications are in accordance with AGA, ASME, and ASTM standards. See your Daniel representative for all the facts.

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Kenneth R. D. Wolfe of **Fisher Governor Co.** was honored with the distinguished service life membership of the **Liquefied Petroleum Gas Association** and the accompanying Seley Award.

The Seley Award is given for outstanding contributions to the LP-Gas Industry. A vice president and director of Fisher, Wolfe began his career in 1927, and has pioneered many devices in wide use today. In the past 30 years Wolfe has been a director of the LPGA, a member and chairman of many committees, a leader in technical training for the gas industry and president of the National LP Gas Council, the industry's public relations-advertising body.

Frank G. Scott, II, has been named assistant superintendent of the **Transcontinental Gas Pipe Line Corporation Gas** Control Department in Houston. Scott has been with Transco since 1951.

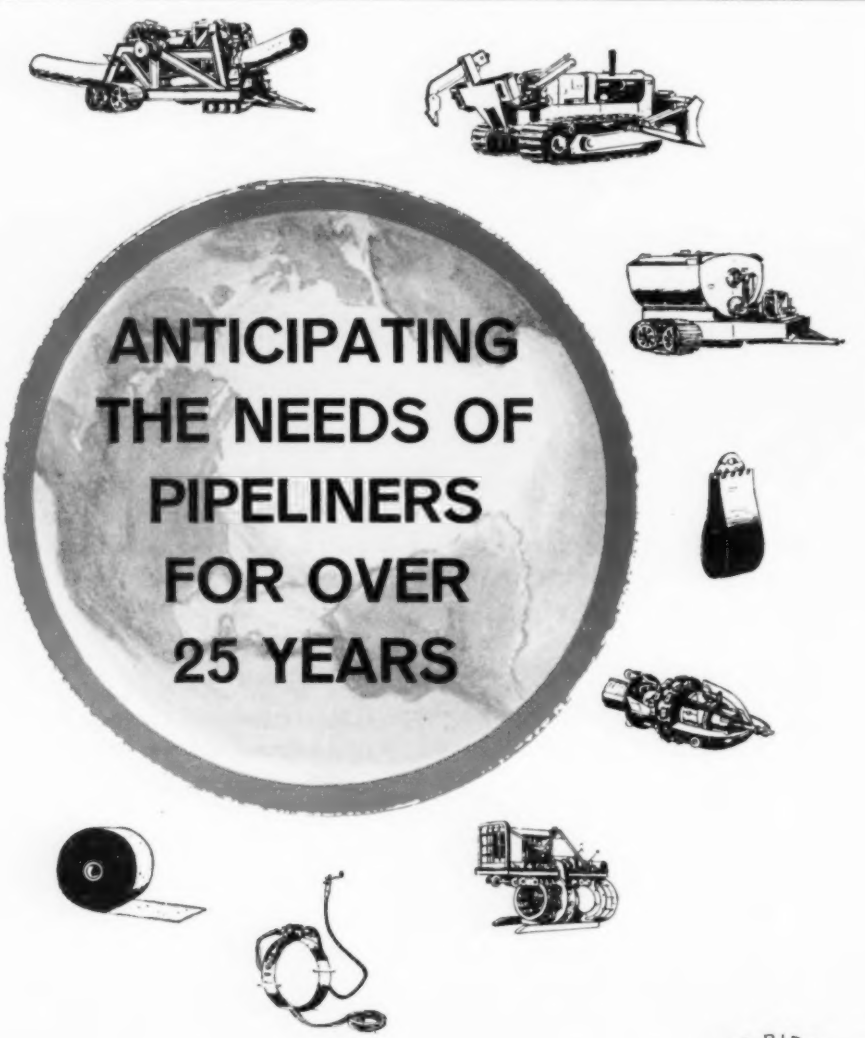
Trunkline Gas Company announces three promotions in its Production and Supply Department. Appointed to district managers of exploration were **Raymond E. Fairchild,** Houston; **Robert H. Dickerson,** Corpus Christi, and **Wallace K. Cox,** Lafayette, La.

Fairchild joined Trunkline in 1956 as a district geologist. Dickerson came to the company in 1959 as a staff geologist and Cox has been with Trunkline since 1958.

Deaths

Bruce Ramsey, 65, former vice president and general manager and member of the board of directors of **Interstate Oil Pipe Line Company,** died of a heart attack in Wilcox, Ariz.

Ramsey served in many executive positions with the Oklahoma Pipe Line Company and its successor, Interstate. He retired in 1955.



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In Canada: Canadian Equipment Sales & Service Co., Ltd., 7310 99th St., Edmonton, Alberta, Canada

WHO'S MEETING WHERE

June

ASME, summer meeting, Statler Hilton Hotel, Dallas, June 5-9.

AIEE, summer general meeting, Atlantic City, N. J., June 20-24.

Canadian Gas Association, annual meeting, Manoir Richelieu Hotel, Murray Bay, Que., Canada, June 22-25.

First International Congress for Automatic Control, sponsored by AACC, with ISA, ASME, IRE, and AIChE cooperating, Moscow, Russia, June 25-July 5. Contact Prof. Rufus Olenburger, Purdue University, Lafayette, Ind.

Michigan Gas Association, annual meeting, Grand Hotel, Mackinac Island, Mich., June 27-28.

Institute of Radio Engineers, fourth national convention on military electronics, Sheraton-Park Hotel, Washington, D. C., June 27-29.

July

ASCE, conference on civil engineering education, University of Michigan, Ann Arbor, Mich., July 6-8.

September

ASME, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass., September 7-9.

NGAA, Rocky Mountain Regional Meeting, Palliser Hotel, Calgary, Alb., September 15.

ASME-AIEE, power conference, Morrison, Chicago, September 15-16.

ASME, petroleum division meeting, Jung Hotel, New Orleans, Sept. 18-21.

Pacific Coast Gas Association, annual convention, Westward Ho Hotel, Phoenix, Ariz., September 21-23.

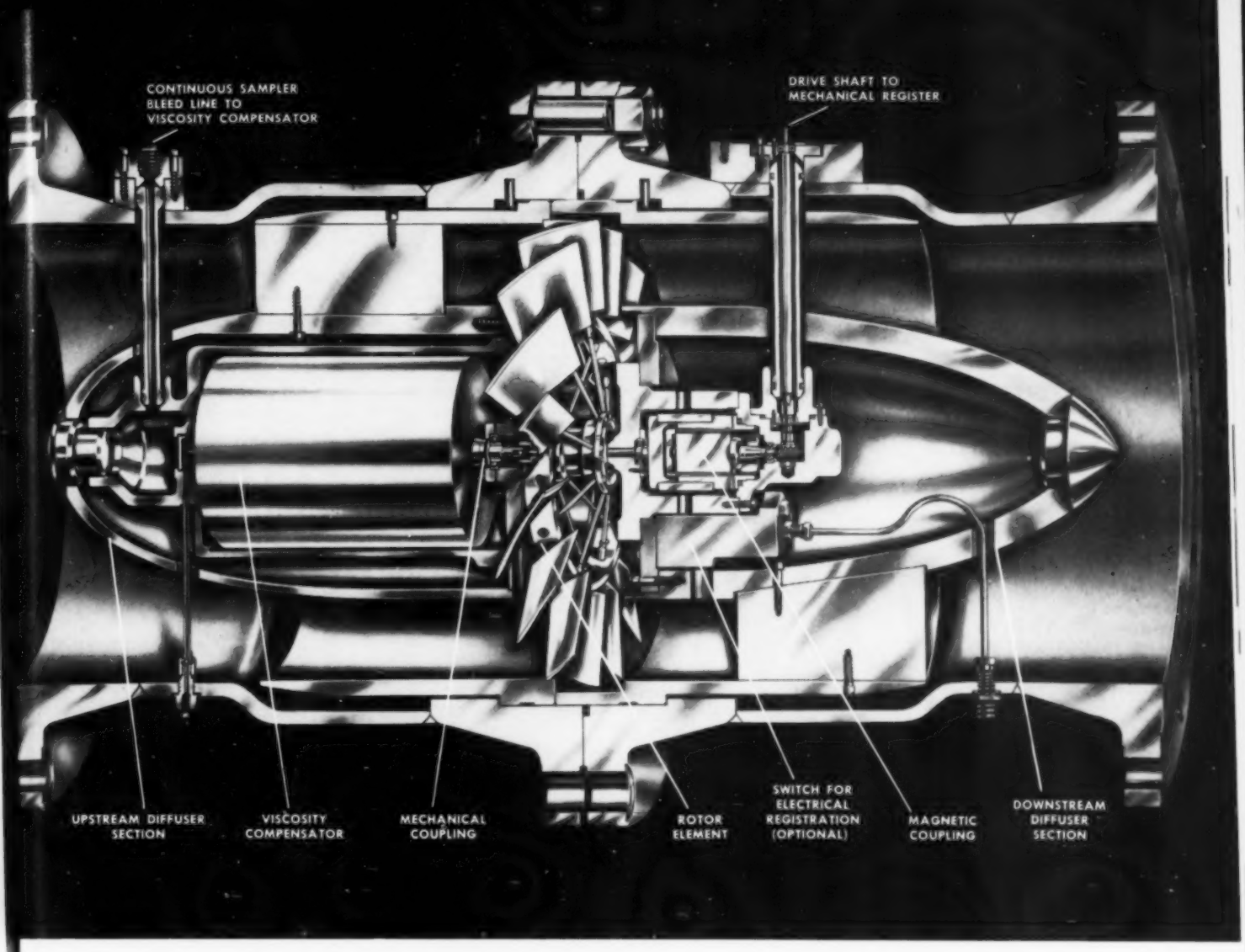
AIEE, electrical conference of petroleum industry, Hotel Skirvin, Oklahoma City, Sept. 25-28.

Instrument Society of America, 15th annual meeting, New York City, September 26-30.

October

NACE, 10th annual Western Region Conference, Sheraton-Palace Hotel, San Francisco, October 6-7.

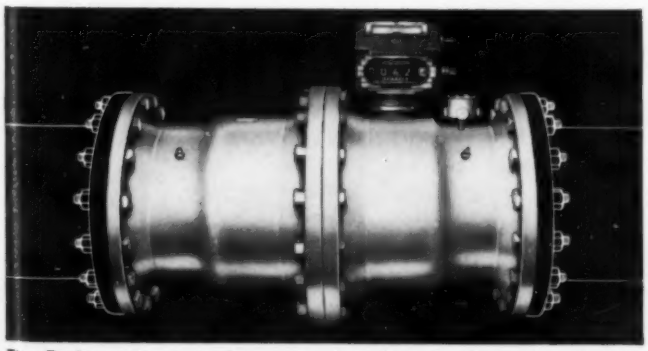
NACE, Southeast Region Conference, Dinkler-Plaza Hotel, Atlanta, Ga., October 6-8.



Look into the New Rockwell Turbo-meter

It thinks for you when viscosities change!

You never need to adjust this meter for viscosities since a built-in viscosity compensator automatically corrects for variances, either due to temperature change or when switching from one product to another.



The Turbo-meter is no larger in pipe diameter than pipe size. Its length is less than three pipe diameters. Compared to other meters it weighs much less.

A balanced, smooth running air foil turbine rotor, mounted on ball bearings provides precision dependable measurement. Head loss is negligible since there are no close clearances or contacting parts. This also cuts wear and keeps the meter in accurate calibration. A magnetic drive to the register eliminates the need for a stuffing box. An electrical pick-up for remote registration is optional.

Designed especially to measure large flows of crude or refined petroleum the Rockwell Turbo-meter will handle up to 15,000 bph in the 16-inch size. *Smaller sizes are now being readied for announcement.* Get full details by writing Rockwell Manufacturing Company, Dept. 125F, Pittsburgh 8, Pa. In Canada, Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

TURBO-METERS

another fine product by

ROCKWELL

LESCHEN WIRE PORTER ROPE DIVISION

H. K. PORTER COMPANY, INC.

What's Happening among SERVICE and SUPPLY MEN

Heyck Equipment Company Established in Houston

T. R. Heyck has formed the Heyck Equipment Company, Inc. with headquarters at 3260 Sul Ross in Houston.

Heyck had been with Curtiss D. Johnson of Johnson-Heyck Inc. since 1949. W. N. Sinclair, formerly with Johnson-Heyck, will be vice president of the new company. Heyck also had spent 10 years with Griscom-Russell Company, manufacturers of heat exchange equipment. His firm will serve the pipe line and process industries.

Delta Tank & Mfg. Co. Inc. Appoints Two Branch Managers

George W. Henderson has been named branch manager, Houston, and Sam Earnest becomes branch manager, Lafayette, La., for Delta Tank & Mfg. Co. Inc. Also appointed to the Houston district was J. Roger Heumann as process sales engineer.

A veteran of 25 years in the petroleum equipment sales, Earnest joined the company in January this year. Henderson, who also joined Delta in January, has been in sales activities for over seven years. Heumann has had 12 years experience in the industry and joined the company in February this year.

Wolverine Tube Appoints New York Sales Manager

T. F. Vigmostad has been named to the post of sales manager of the Wolverine Tube New York district. Formerly sales manager of the St. Louis district, Vigmostad has worked in sales since 1950. He will be responsible for activities in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, northern New Jersey and New York.

Chemetron Corporation Plans To Acquire Clyde Tube Forgings Ltd.

Chemetron Corporation announces plans to acquire Clyde Tube Forgings Ltd., a British manufacturer of welding fittings for industrial piping and pipe lines systems. Tube Tube division of Chemetron will coordinate the firm's operations with its own.

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Pipeline
Cleaner

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CRUDE LINES
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FOR DETAILS WRITE

Pipeline Cleaners Co.
Fort Madison, Iowa

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DOUBLE POWERED
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Available on rental or lease-purchase plan.

The Model "6B" two-stage, double-acting pump, powered by air, gas or water pressure, delivers discharge pressures up to 20,000 psi. Discharge pressure is in direct ratio to, and controlled by, powering pressure. Ideally suited for all types of hydrostatic testing in the plant or field. Write for complete data and specifications.

UDELL INC.

SALES OFFICE
5117 Gulfton — P. O. Box 18305
Houston, Texas

PROTECTION
is our business

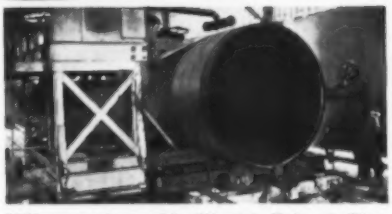
The protection of pipe lines is a major concern with Nicolet Industries. Every product that bears the name of Nicolet is the finest of its kind. That is why NICOLET ASBESTOS PIPE LINE FELTS and NICOLET "OLD NIC" GLASS WRAP are so widely used and specified.

And, that is why so many forward looking Mill Wrap operations rely heavily upon Nicolet Pipe Wraps.

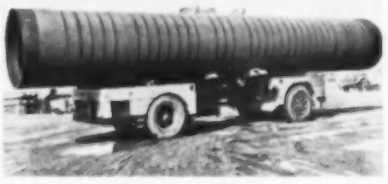
We are proud of the important part we play in the complete pipe protection provided by the better Mill Wrap and Over-The-Ditch operators.

To continue to merit the confidence placed in Nicolet Pipe Line Felts and Glass Wrap, Nicolet maintains the most rigid of Quality Control Systems. From our Asbestos Mines to finished product, you are assured of complete adherence to specifications.

More and more Corrosion Engineers are specifying Nicolet Asbestos Pipe Line Felts and Nicolet "Old Nic" Glass Wrap. You, too, should write today for samples and specifications.



Mill wrapping with Nicolet Felt at Pipe Protection Service, Inc., Kearny, N. J.



72" pipe wrapped with Nicolet Felt by Pipe Protection Service, Inc.

Nicolet Industries, Inc., Florham Park, New Jersey

O.K., send me samples and specifications of:

☐ **Nicolet Asbestos Pipe Line Felts and "Old Nic" Glass Wrap**

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Company _____

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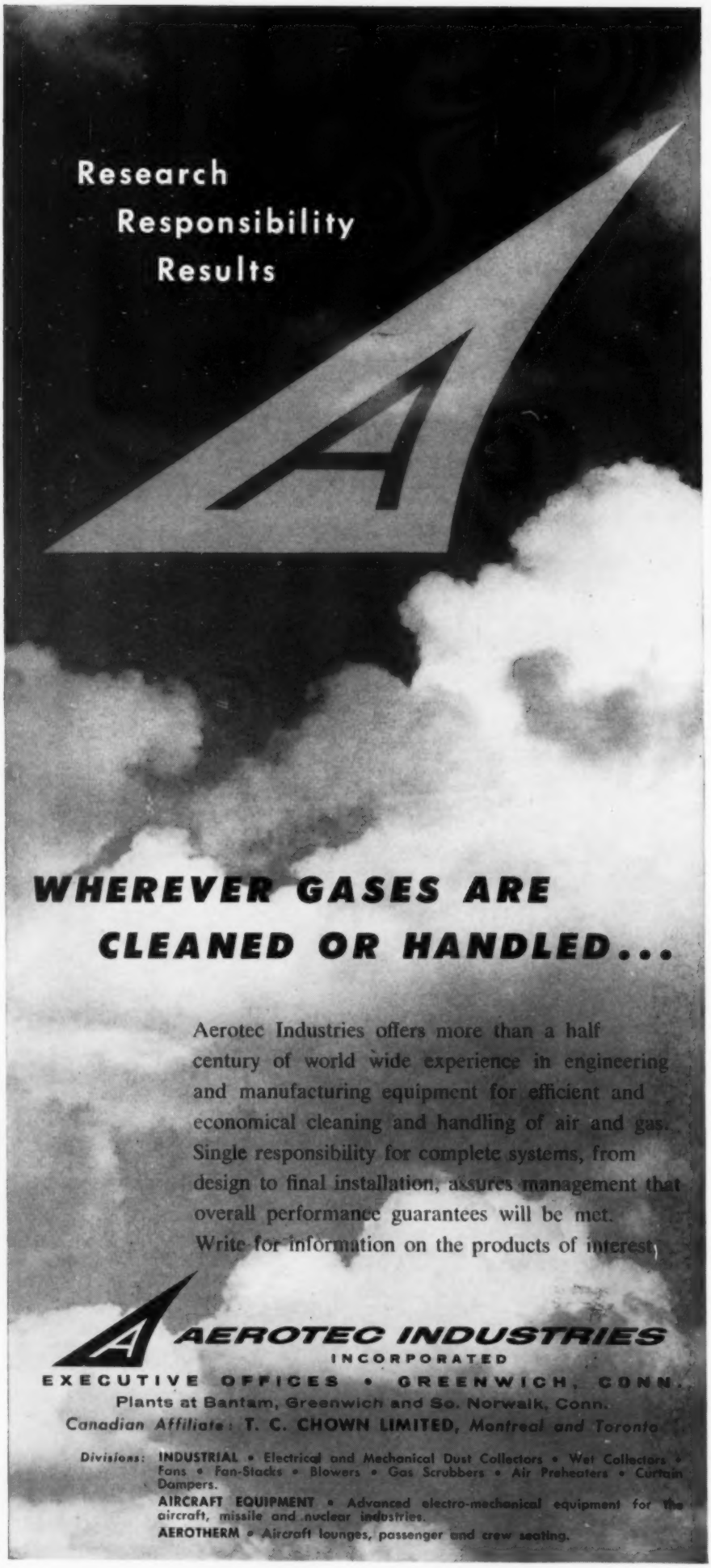
Distributed throughout the United States • District Sales Offices: Ford & Washington Streets, Norristown, Pa.; P.O. Box 777, Hamilton, Ohio

NICOLET INDUSTRIES, INC.

FLORHAM PARK, NEW JERSEY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Responsibility
Results
WHEREVER GASES ARE
CLEANED OR HANDLED...
Aerotec Industries offers more than a half century of world wide experience in engineering and manufacturing equipment for efficient and economical cleaning and handling of air and gas. Single responsibility for complete systems, from design to final installation, assures management that overall performance guarantees will be met. Write for information on the products of interest.
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AIRCRAFT EQUIPMENT • Advanced electro-mechanical equipment for the aircraft, missile and nuclear industries.
AEROTHERM • Aircraft lounges, passenger and crew seating.

Petroleum Electric Supply Assoc. Elects John D. Trilsch President

John D. Trilsch has been elected president of the Petroleum Electric Supply Association. Trilsch is president of the Trilsch Corp. C. A. Gunn, Copperweld Sales Co., was named vice president and Marvin Gunter, Motorola C & E, was elected executive secretary of the association.

Named to the board of directors were Felix House, Crouse-Hinds Co.; Pat Wilson, Southwestern Bell Telephone Co.; Harry Holquist, Pipe Line News; Gene Tuel, Railway Communications; George Ullrich, Harrison Equipment Co.; Pat King, Westinghouse Electric; Theil Sharpe, Collins Radio; Haskell Shelton, S & S Radio; W. H. Thompson, General Telephone of Southwest, and Trilsch, Gunn and Gunter.

F. G. Fabian, Jr.

Charles Kuhn

Dresser Industries, Inc., Names F. G. Fabian, Jr., Vice President

Dresser Industries, Inc., has promoted F. G. Fabian, Jr., to vice president of the company and named Charles Kuhn president of Dresser Manufacturing Division, succeeding Fabian.

Fabian joined Dresser in 1953, he had been president and general manager of the Dresser Manufacturing Division since 1955. Kuhn had been vice president and sales manager of Dresser Manufacturing.

Allis-Chalmers Announces Several Sales Representative Appointments

Several sales representatives have been appointed by Allis-Chalmers Manufacturing Company. Merlin F. Schwenk becomes representative in the Syracuse district. Kenneth W. Geiser has been transferred from Syracuse to petroleum and chemical sales section of the New York district.

George A. Krail Jr., has been assigned sales representative to the Allentown district. Eugene R. Glazier has been appointed to the Denver district and Harvey L. Stahl joins the Dallas district.

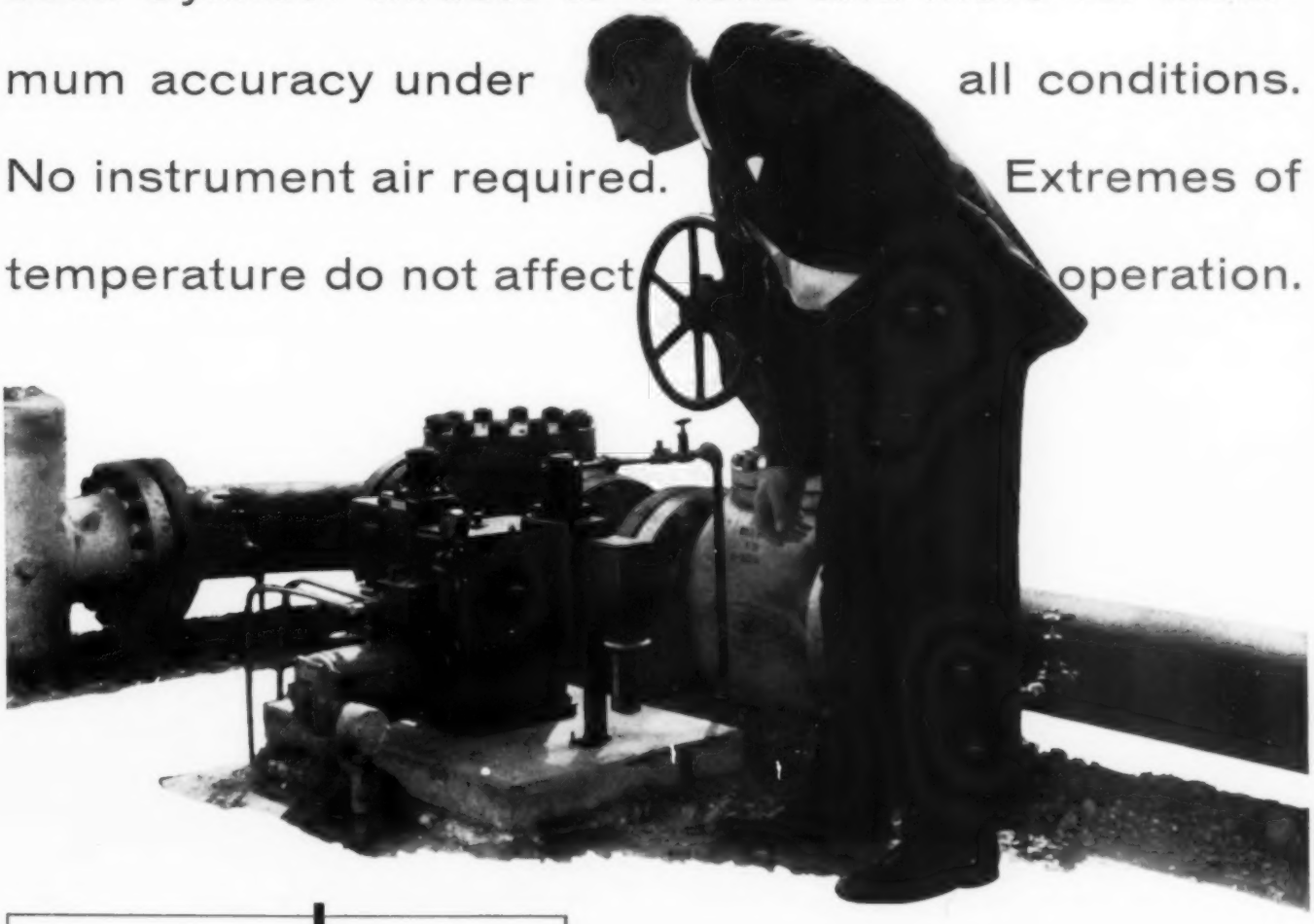
Other appointments by Allis-Chalmers include Thomas E. De Wan, assistant engineer, screen section, Processing Machinery Department; Lawrence G. Karvonen, assistant engineer, office of director of mechanical engineering; Donald F. Lowe, research engineering scientist, process and mechanical research group, and George P. Warner, research process laboratory.

Berman to Head Technical Sales For Engelhard Industries, Inc.

Harold B. Berman has been appointed director of technical sales and development of platinized titanium electrodes. Berman has been responsible for the design and installation of a number of plants

For more data on advertised products, use Readers' Service Cards, last page.

Suction pressure, discharge pressure, rate of pressure change, and more complex combinations with pump motor current override, etc., are all being controlled by **GPE Controls** equipment in stations that are unattended 24 hours a day. Weatherproof transmitter-controller-hydraulic relay package eliminates control panel and enclosure, cuts installation cost. Cylinder thrusts to 5 tons and more for maximum accuracy under all conditions. No instrument air required. Extremes of temperature do not affect operation.



GPE Controls — A GENERAL PRECISION COMPANY

Write for descriptive literature

GPE Controls, Inc.

240 East Ontario Street • Chicago 11, Illinois

A Subsidiary of GENERAL PRECISION EQUIPMENT CORPORATION

IDEAL BOND

The essence of pipeprotection is a perfect bond of the coatings and wrappings to the pipe and to each other.

Under Standard Specifications, your pipe is steel grit cleaned to remove all dust, mill scale and moisture and to provide many tiny facets to help bond the primer to the pipe.

1) The primer is bonded to the pipe.
2) The enamel is bonded to the primer.
3) Your wrappings are applied in a manner to assure maximum protection.

The pipe is then wrapped in kraft paper and electrically holiday detected. These processes are carried on at the exactly correct temperatures of all materials. In our storage area for wrappings, humidity is controlled to eliminate moisture.

This results in a perfectly bonded, unified coating and wrapping protection. **Ideal bond, resulting in long life for your pipe, is always obtained at Standard Pipeprotection Inc.**

SP®
standard pipeprotection inc.
3000 SOUTH BRENTWOOD BLVD. • ST. LOUIS 17, MISSOURI

while associated with Signmaster & Breyer Inc.

The new type electrodes are being made by Engelhard under an agreement with a British firm, Imperial Industries, Ltd. Berman's duties will include technical assistance to customers in the design, construction and start-up of facilities utilizing these electrodes.

Dr. R. W. Guard

George Hemmeter

General Electric Metallurgical Dept. Appoints Guard & Hemeter Managers

Dr. R. W. Guard and George Hemmeter have been promoted in the General Electric Metallurgical Department. Guard becomes manager—product and process development engineering, Diamond Products Section.

Hemmeter has been named manager of manufacturing, specialty alloys section, Metallurgical Products Department. Hemmeter has been with General Electric since 1947. Since 1954 he had been manager—metallurgical research and development at the Fort Wayne laboratory. He is a member of Ft. Wayne Chapter, ASM, and was charter chairman in 1958-59. Also, he is a member of the Engineers Council, State of Indiana.

Guard will head the company's expanding program to develop new diamond products for use in a much wider range of applications, as well as new products of superpressure technology. Guard formerly was with the General Electric Research Laboratory where he worked on high temperature alloys development in the Alloys Studies Section.

Southwest Industries, Inc., Establishes Subsidiary Co.

Southwest Industries, Inc., has formed a new subsidiary, Southwest Engineers, Inc., to specialize in the engineering and design of all types of facilities for the processing of oil and gas.

Officers include J. M. Haring, president; C. B. Kilgore, vice president, and Emil G. Nasser, vice president. Haring has been associated with Tennessee Gas Transmission Company, and the Nickles Machine Corp., where he served as chief engineer. Nasser was with Fluor Corp. Ltd., before joining the company. Kilgore also, served with Fluor Corp., Ltd., prior to joining Southwest.

Road Boring and Tunneling Co. Names Miles Secretary-Treasurer

Road Boring and Tunneling Company has appointed Curtis L. Miles secretary-treasurer and controller of the Bortunco subsidiary. He has had extensive experience in the construction and drilling industry. Miles is a member of the American Institution of Certified Public Accountants and Houston Chapter of Texas Society of Certified Public Accountants.

For more data on advertised products, use Readers' Service Cards, last page.

CROUSE-HINDS

EV Series
Explosion-Proof
Lighting Fixtures

Highest Efficiency . . . Easier to install, relamp, maintain . . .

The EV series offers exactly the right fixture for any area made hazardous by flammable atmospheres of vapors or gases, as defined under Class I of the National Electrical Code.

Basic EV Incandescent Fixtures
(Groups C & D)

are of strong, shock-resistant construction, contain internal explosions without rupturing. Threaded joints are flame-tight . . . no sealing compound required on installation. Gas tightness not required for safe operation . . . just turn off line current when relamping. Maximum corrosion-resistance. 75-500W.

EVA Incandescent Fixtures
(Groups A & B)

comprise the first complete, UL-approved lighting system for acetylene and hydrogen locations. Lamp and wiring compartments are separate and individually explosion-proof. 150-300W.

EVA Mercury Vapor Fixtures
(Groups C & D)

provide important operating economies in hazardous areas: *2.5 times more light output per Watt* than incandescents . . . greatly reduced frequency of relamping. 250-400W.

For Complete Information on Crouse-Hinds explosion-proof lighting equipment, call your Crouse-Hinds distributor, or write us. EV Lighting Fixtures are available in all reflector types: Holophane Prismatic (illustrated); slotted dome and angle; and conventional (unslotted) in all shapes and sizes.

CROUSE HINDS
SYRACUSE NEW YORK

OFFICES: Atlanta Baton Rouge Birmingham Boston Buffalo Charlotte Chicago Cincinnati Cleveland Corpus Christi Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee New Orleans New York Omaha Philadelphia Pittsburgh Portland, Ore. St. Louis St. Paul Salt Lake City San Francisco Seattle Tulsa Washington
RESIDENT REPRESENTATIVES: Albany Baltimore Reading, Pa. Richmond, Va.
Crouse-Hinds of Canada, Ltd., Toronto, Ont. Domex, Mexico City, D.F. Peterco, Sao Paulo, Brazil

For More Dependable Equipment and Service

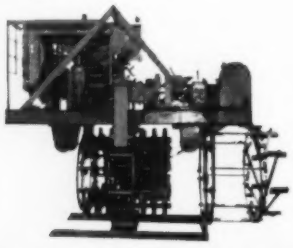
Specify

MYOCO

CLEANING and PRIMING MACHINE

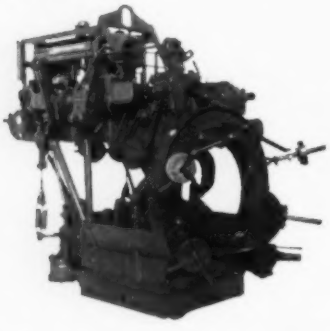
The MYOCO Cleaning and Priming Machines are available in sizes 3" thru 36". Pictured here is the 26"-32" size with two counter-rotating heads featuring the special MYOCO design counter-rotating gear box.

It is powered by an International U-9 self-starting engine and uses the Ramsey transmission. Engine exhaust is utilized to heat primer tank.



COATING and WRAPPING MACHINE

The MYOCO Coating and Wrapping Machine is powered by an International gasoline engine, with electric starter, spray type shoes, and heavy-duty transmissions and clutches. This new machine features under-pressure-crawler wheels equipped with hydraulic cylinder to maintain positive contact, easily controlled by the operator.



When you use MYOCO pipeline equipment, you quickly find that servicemen are experienced and available twenty-four hours a day with fast transportation available to serve you in any way; efficient equipment operation is assured by periodical checks; and if possible, parts and supplies are shipped the same day ordered.

MORRIS-YOUNG-OWENS CO. PIPELINE EQUIPMENT AND SUPPLIES MYOCO

MORRIS-YOUNG-OWENS CO.

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In Canada: MYOCO LIMITED, Rural Route 1, Midland Ave. N., Agincourt, Ontario, Canada

Tel. AX 3-1211

W. F. Krueger Named Manufacturers Representative for Three Companies

W. F. Krueger has been named manufacturers representative for three pipe line supply companies. With headquarters in Houston, Krueger will be associated with Allen Edwards, Inc., The Pipe-Line Development Company and Remco Manufacturing Co., Inc.

W. F. Krueger

He had been with Dresser Manufacturing Division since 1956, and was appointed head of the Pipe Line Products Department in 1959. Prior to his association with Dresser, he had served with the Sperry-Sun Well Surveying Company. Previously he had been with the U. S. Bureau of Mines and Standard Oil Company of New Jersey.

Krueger will handle concrete river weights, reinforcing sleeves, concrete marker posts and half soles for Allen Edwards; cleaning, priming, coating and wrapping equipment for Remco; weld ends, split sleeves, and special flanges for Pipe Line Development Company. His territory will include portions of Texas and Louisiana.

A. O. Smith Corporation Announces Reorganization

T. H. Creden

H. D. Barnes

Reorganization of one of its major grouping of divisions and the appointments of three new division managers has been announced by A. O. Smith Corporation.

The Petroleum Group becomes the Capital Equipment Group. It will include the Tubular Division, the present Process Equipment Division, Aero Western Division, and a wholly-owned subsidiary, Glascote Products, Incorporated. A new Space-Ordnance Division has been created and the Process equipment becomes the Atomic and Process Equipment Division.

W. Hendricksen

Thomas H. Creden has been appointed general manager of the Tubular Division, and Warren Hendricksen assumes same position with the Atomic and Process Equipment Division, both newly created posts. H. D. Barnes becomes head of the Space-Ordnance Division.

Creden joined A. O. Smith in 1935 and has been associated with its line pipe activities in New York, Tulsa, Dallas and Milwaukee. He also is vice president of the A. O. Smith Corporation of Texas at Houston. Hendricksen joined the company in 1941, became eastern district sales manager in 1943 and was named head of sales for Process Equipment Division in 1954.

Barnes has been with the company since 1927 and prior to his recent appointment had been director of Defense Products and Atomic Energy Equipment.

Cooper-Bessemer Corp. Appoints Dangler, Bramley Sales Engineers

James C. Dangler and Don B. Bramley have been appointed sales engineers by Cooper-Bessemer Corporation. Dangler will work under supervision of Fletcher M. Devin, vice president and district sales manager of the East-Central sales district. Dangler has been associated with the Oster Manufacturing Company since 1947 and had been assistant to the president.

Bramley will work under Frank J. Hunter, St. Louis branch manager. With headquarters in Kansas City, Bramley will serve as a specialist in the sale of Cooper-Bessemer gas, diesel and gas-diesel engines for municipal power plants and other stationary power services in the Missouri, Kansas, Nebraska and Iowa areas.

Applied Power Equipment & Mfg. Co. Named Distributor of Red Seal Engines

Continental Motors Corporation has appointed Applied Power Equipment & Mfg. Co. distributor of Red Seal Engines. Stocks of engines and parts will be maintained in Houston and Alice, Texas. Mechanical services will be provided for users of Red Seal Engines on an around the clock basis from these locations.

Applied Power Equipment will continue to sell and service Allis-Chalmers and Buda engines along with a complete line of necessary items as in the past.

WELDING CABLE

AT LOW PRICES

CUT-TO-LENGTH

#8 ..	7½¢ ft.	#1 .	24¢ ft.
#6 ..	9½¢ ft.	#1/0 .	29½¢ ft.
#4 ..	12½¢ ft.	#2/0 .	36½¢ ft.
#3 ..	15½¢ ft.	#3/0 .	46¢ ft.
#2 ..	19½¢ ft.	#4/0 .	56¢ ft.

5% Discount For Full Reels of 500 ft. and 1000 ft.

We Pay Freight on 300# or More

Add 10% For Orders Under 100 ft.

Call Universal for all Electric Wire and Cable Needs

Write for our 1960 Stock Sheet

UNIVERSAL WIRE & CABLE CO.

2935 N. Paulina St. Chicago 13

Branch Warehouses

Houston, Los Angeles and Denver

ANY KIND OF PIPE FOR THE OIL INDUSTRY

SEAMLESS
AND WELDED
LINE PIPE TO API 5L
AND 5 LX. Seamless from
1/8'' up to 16'' OD incl.
Butt welded from 1/4'' up to 3''
OD incl. ERW from 1/4'' up to 16''
OD incl. Cold expanded from 20'' up
to 40'' OD incl. OIL COUNTRY TUBU-
LAR GOODS IN ALL API GRADES
INTEGRAL JOINTS OF CASING
(Spang extreme line, Buttress, Lacq)
AND TUBING (Lacq T1 and T2)
SPECIAL SOUR GAS
CORROSION RESIS-
TANT TUBING

The Comptoir F. B. T. groups the leading steel-tube plants of France and Belgium

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D'EXPORTATION DES TUBES D'ACIER

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Representative in the U.S.A.
Continental Tube Company
1631, Bank of Commerce Building Houston 2, Texas

H·S

ONLY THE NEW TD-25 "BOOM" GIVES YOU

Now—International Superior announces the new TD-25 sideboom.

Now, you get the pipe-handling wallop of 230 direct-started, turbocharged Diesel hp. *Plus* the exclusive teamwork of "live track" Planet Power-steering and Hi-Lo power-shifting!

"Live power" on both tracks full time, with fingertip speed control of either track, lets you turn smoothly with the pipe load, upgrade or down. Load-limiting "dead-track drag" is eliminated. And you can power-shift the "25" up or down, on-the-go, in forward or reverse. *TD-25 standard equipment gives you pipe-handling maneuverability that no king-sized clutch-steered crawler can deliver, even with costliest attachments!*

The "25" is platformed on new 7-roller tracks with double-box-beam frames. This design assures super undercarriage strength for slam-bang conditions—*plus* mud-and-mountain beating flotation and stability. Heavy-duty TD-25 Dura-Rollers defy the pipelining "grind"—with the industry's thickest shells, to

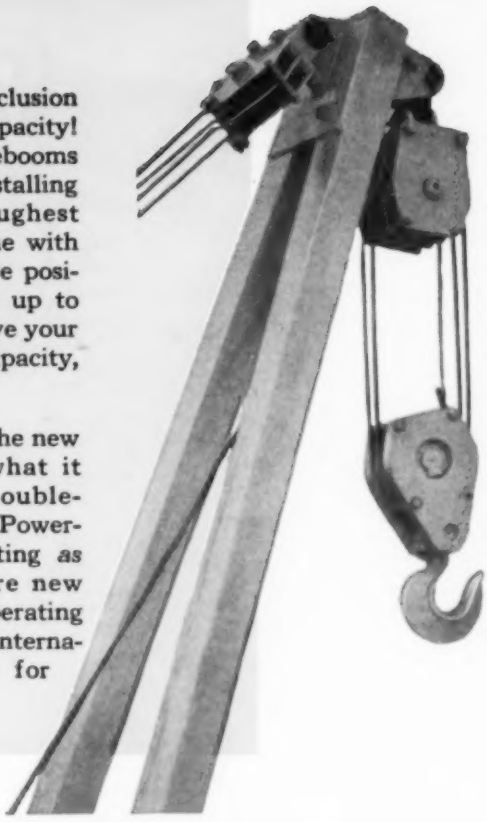
Planet Power-steering and p

New International Superior TD-25 Sideboom lifts 130,000 lbs. at 4' overhang. Six quick-change counterweights with big lifting eyes save up to 90% on time needed to adapt rig for any "lift" or "carry." Unit is powered by the 6-cylinder, direct-start DT-817 Diesel—developing 230 high-torque hp!

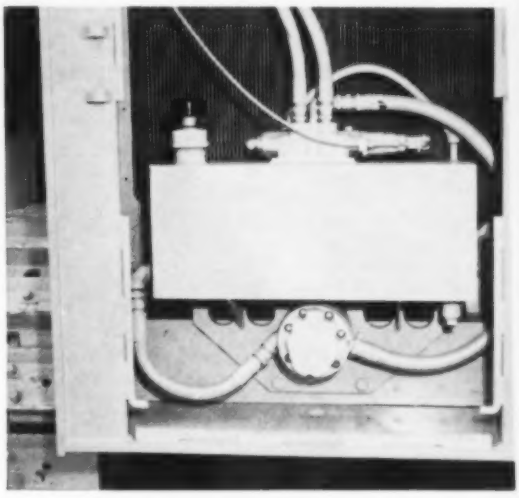
prevent flexing—positive grit-exclusion—and 1,000-hr-interval lube capacity!

No wonder new TD-25 sidebooms can "show other makes how," installing difficult sections—beating toughest weather and terrain—saving time with accurate lowering and gate-valve positioning—leap-frogging at speeds up to 7.7 mph. New "25" sidebooms give your whole spread new pipe-laying capacity, all the way!

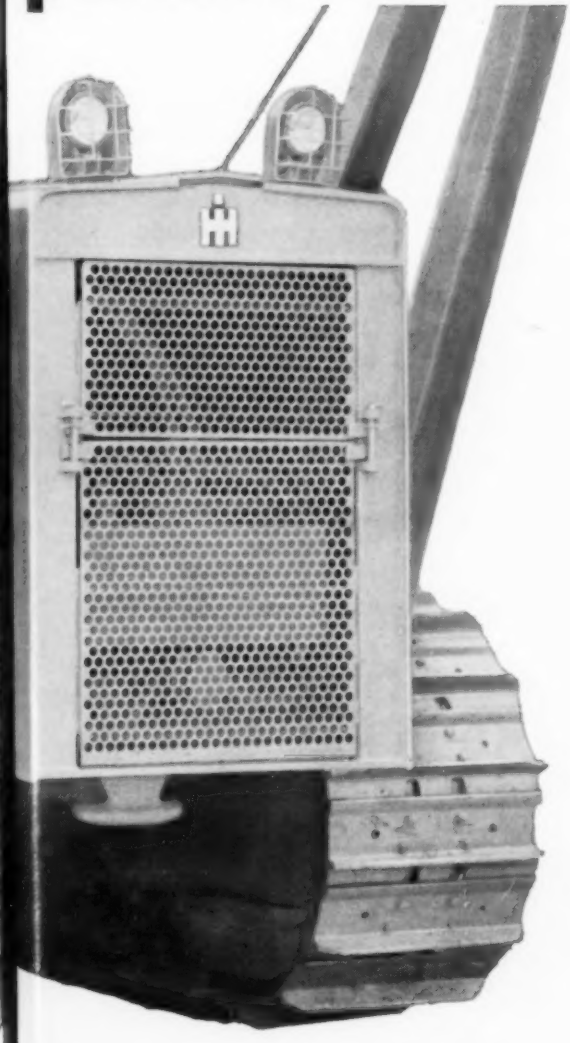
Power-steer and power-shift the new TD-25 sideboom—compare what it means to get the exclusive, double-barreled advantages of Planet Power-steering and Hi-Lo power-shifting *as standard equipment*. Compare new TD-25 sideboom capacity, operating ease and economy. See your International Superior Distributor for a demonstration.

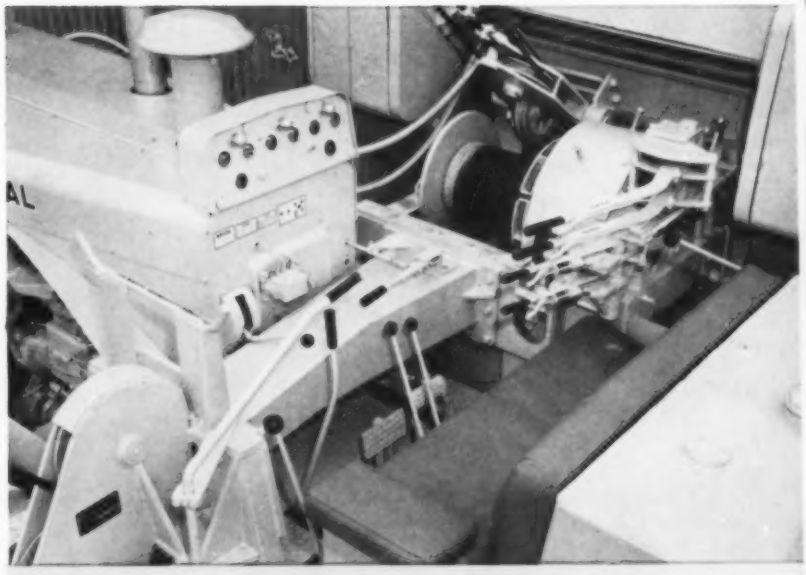


New TD-25 sideboom hydraulic system features increased capacity, and exclusive new accessibility. Step-up in hydraulic power speeds boom action—while retaining famous International Superior sideboom slip-proof, inch-close, pipe-handling accuracy. To service this protected hydraulic system, simply unlatch radiator-guard door!



power-shifting, as standard!





Note the safe, comfortable, production-practical operator's compartment! Read-easy instrument panel is at eye level. Reach-easy boom-control levers are vertically stacked. New fleeting sheave is provided over boom drum—another big contribution to high availability and long cable life!

International Harvester Company, Chicago 1, Illinois

INTERNATIONAL®

SUPERIOR

6005

. . . AT NO EXTRA COST!

Compare these money-saving Midwest Long Tangent elbows (one of five types offered) with ordinary long radius ells! The Long Tangent type provides 21% greater length on 90° ells, 42% more on 45° ells. Only Midwest gives you this bonus *at no extra cost!*

Long Tangent elbows save time and money in many ways: (1) they save on pipe; (2) they save by eliminating short nipples and extra welds; (3) they save time in applying slip-on flanges or sleeves; (4) they save time in lining-up and clamping pipe; and (5) it is easier to replace an ordinary ell with a Midwest Long Tangent than with another ASA ell.

Only Midwest manufactures and stocks Long Tangent ells in a complete size range through 36″. Also available with special tangent lengths at slight additional charge.

Write for catalog which shows complete selection of Midwest welded-type and seamless fittings.

Sold through Stocking Distributors from Coast to Coast

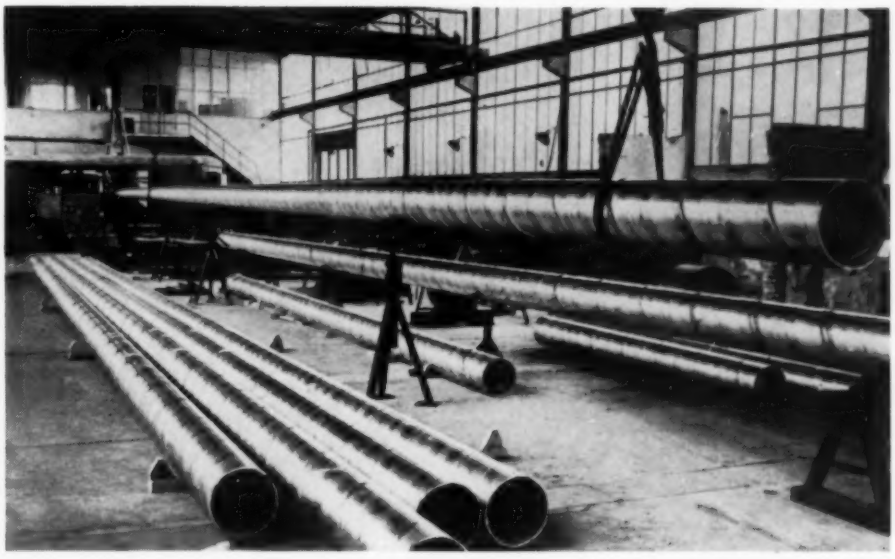
21% MORE ELBOW

MIDWEST

MIDWEST PIPING COMPANY, INC.
1450 S. Second Street St. Louis 4, Missouri

THE WORLD'S MOST COMPLETE LINE— SEAMLESS AND WELDED-TYPE FITTINGS

What's New in EQUIPMENT



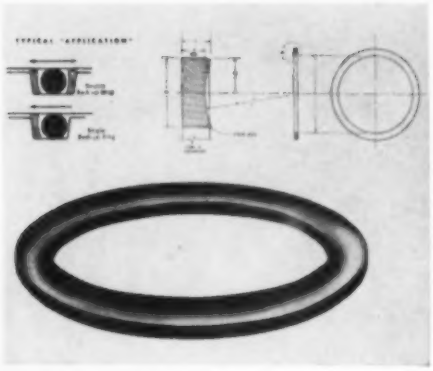
Portable Pipe Mill For Spiral Weld Pipe

A portable pipe mill for spiral weld pipe which can fabricate any size pipe has been introduced by David Douglas & Co., Inc. The process was developed by Vilam Eckhardt and is known as the DRIAM process.

The company offers this process for steel and aluminum pipe. Machines can be mounted on trailers, and a machine capable of making up to 28-inch diameter pipe can be installed on one trailer. Pipe diameters exceeding 28-inches requires two trailers to transport necessary machinery.

The machine capable of rolling pipe up to 10-inches weighs 9 tons and a machine for 28-inch pipe weighs 26 tons. The machine is easily altered for production on one size to another, and the length of tube produced is unlimited. These portable machines are designed for double-welded spiral-pipe fabrication on the right-of-way which would eliminate the need of transportation.

For more data, circle **No. E1** on Readers' Service Card, last page this issue.



Back-Up Rings

Continuous back-up rings for O-ring-in groove installations have been introduced by Parker Seal Company. The Parbaks are designed with a concave shape to prevent O-ring extrusion and increase lubrication of the O-ring. They are continuous one-piece rings moulded of a compound resistant to most fluid.

The rings may be used in all standard pressure systems and have a temperature range from —85° to 350°F.

For more data, circle **No. E3** on Readers' Service Card, last page this issue.

Station Controls

Shell Pipe Line Corporation has announced a new fully automatic control device to permit improved operation of unattended pipe line pump stations. The Power Level Controller, is capable of maintaining, without outside assistance, the optimum power level of a pumping station for most economical pumping of any predetermined volume. The unit's ability to function automatically and independently eliminates possibility of shutdown caused by communications failures.

Detailed design and manufacture of the power controller were developed by Southwestern Industrial Electronics Company.

For more data, circle **No. E4** on Readers' Service Card, last page this issue.

Welding Fittings

Midwest Piping Company announces a seamless carbon steel welding fittings to its line of welded-type fittings. Available in all types, the fittings range in all sizes through 24-inch.

Each fitting is hot coined—sized in compression for its entire length, producing true overall roundness which permits segmenting at any point. Ends of the fittings are machined inside and out; both ends are machined simultaneously with the fitting in a fixed position to assure fittings that are plumb and square.

For more data, circle **No. E2** on Readers' Service Card, last page this issue.

Cleaning-Taping Machine

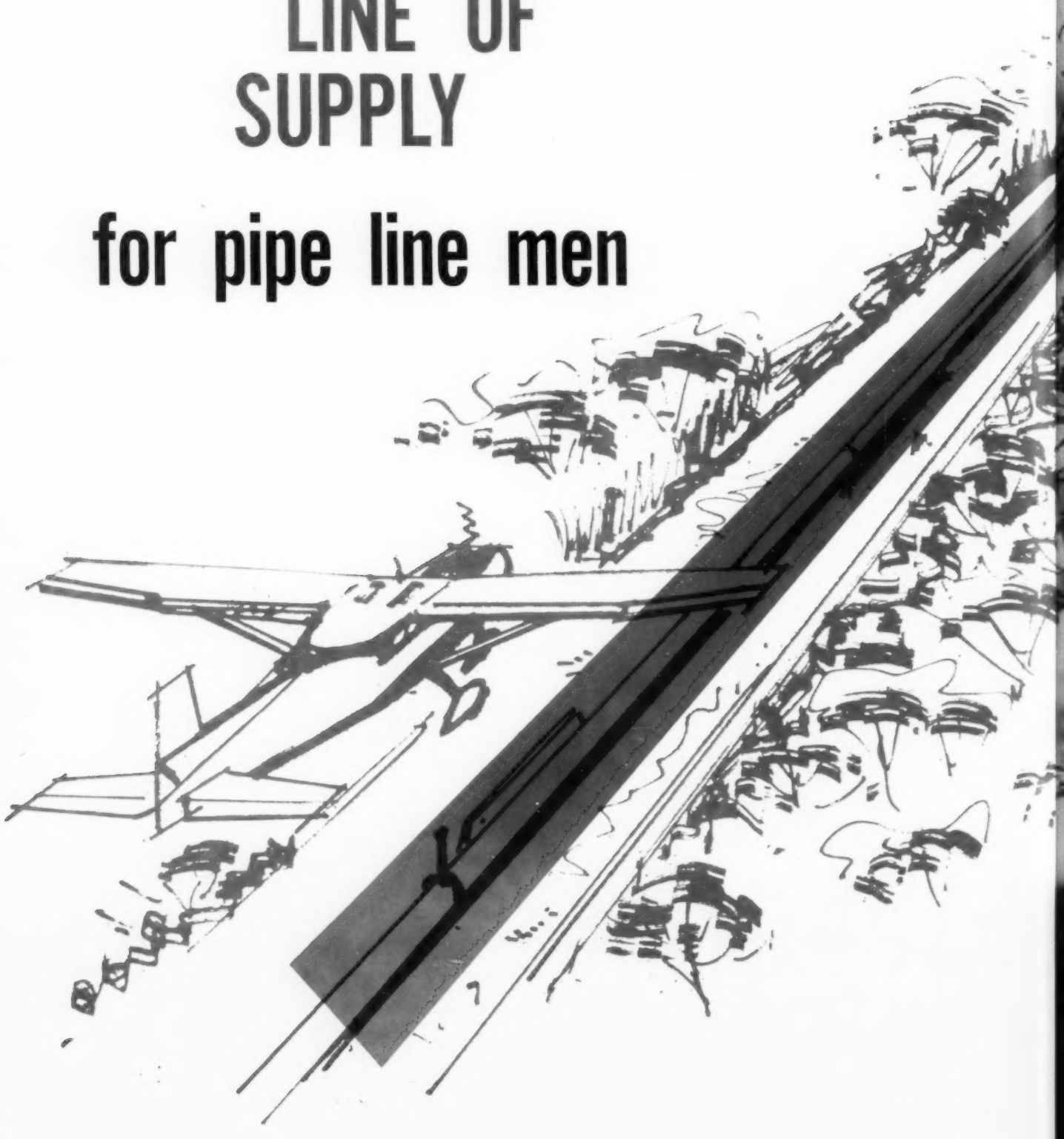
A portable pipe-cleaning and taping machine for pipe from ¾-inch to 4 inches in diameter has been introduced by A. B. Betzel Engineering Company. It can be set up in one hour and dissembled in 30 minutes. Five men operate the machine which can clean and tape 2,500 plus lineal feet of pipe per hour, according to manufacturer.

The machine can be ordered mounted on trailer or steel skids.

For more data, circle **No. E5** on Readers' Service Card, last page this issue.

THE STRAIGHTEST LINE OF SUPPLY

for pipe line men



If you buy for the pipe line industry, you don't need to maintain an elaborate, bulky file of suppliers' literature. Simply keep at hand your copy of PIPE LINE CATALOG . . . the shortest, most efficient pipe line between you and pipe line equipment, materials and services.

Hundreds of manufacturers, suppliers and service companies file complete or condensed catalogs in PIPE LINE CATALOG . . . many publish no other catalog. If you use the catalog for your buying, you take advantage of a convenient, up-to-date, one-volume, reference. You have constantly available complete information and comparative data on thousands of products and services.

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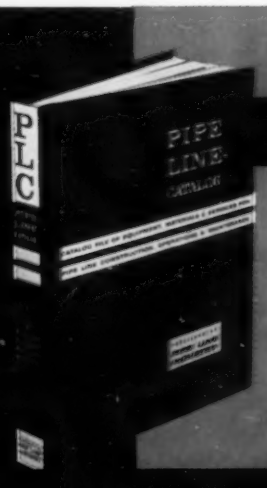

PIPE LINE CATALOG

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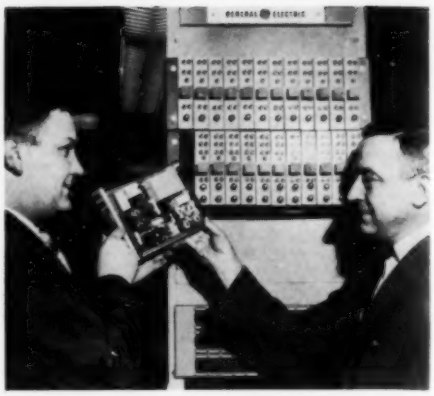


Transistorized Carrier

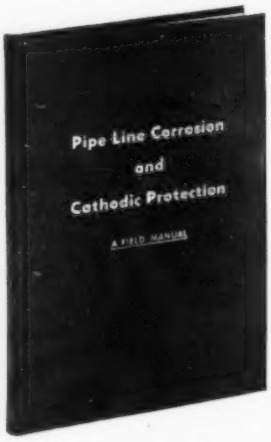
A transistorized multiplex-carrier system has been developed by General Electric Company. The system is capable of handling up to 600-voice frequency channels on a single radio beam.

The single sideband suppressed carrier system has toll quality capable of meeting long-distance standards. It is designed for use by pipe lines, utilities and other users of microwave and cable systems.

Compactness is a feature of the unit. It is a third the size of conventional tubed equipment. The system makes possible 120 channels in an 8-foot rack space. The new equipment will make expansion possible without wall alterations.

(This item supplements General Electric Co. data on pages 199-202 of the Pipe Line Catalog, Second Revision.)

For more data, circle **No. E6** on Readers' Service Card, last page this issue.



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Pipe Line Corrosion and Cathodic Protection

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This book is designed as a practical field manual. It provides workable methods that can save you valuable time and effort in obtaining interpretive field data.

Contents (Condensed). Soil Resistivity Surveys, Pipe-to-Soil Potentials, Line Currents, Current Requirement Surveys, Rectifier System for Coated Lines, Ground Bed Design and Installation, Magnesium Anodes on Coated Lines, Hot Spot Detection, Stray Current Electrolysis, Interference in Cathodic Protection, Operation and Maintenance, Coating Inspection and Testing.

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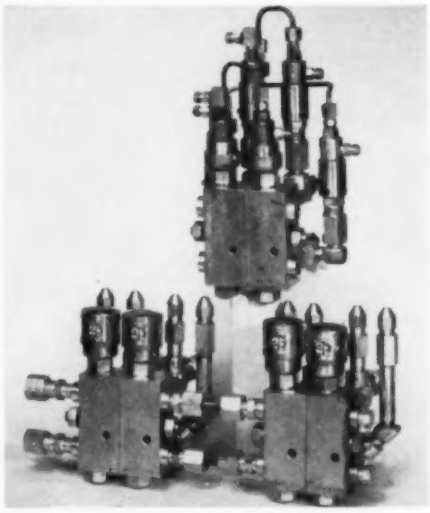


Lubrication System

An automatic lubrication system for compressors and power cylinders has been developed by Meter-Pak. It is a pneumatic system of delivering lubricants in precise amounts consistently and at prescribed intervals to compressors.

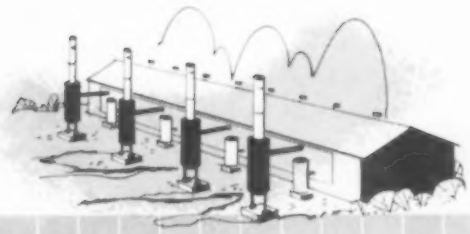
Available for pressure ranges up to 7,000 psi, the system features safety control, positive proof of oil delivery, cycling control and ability to handle synthetic oils.

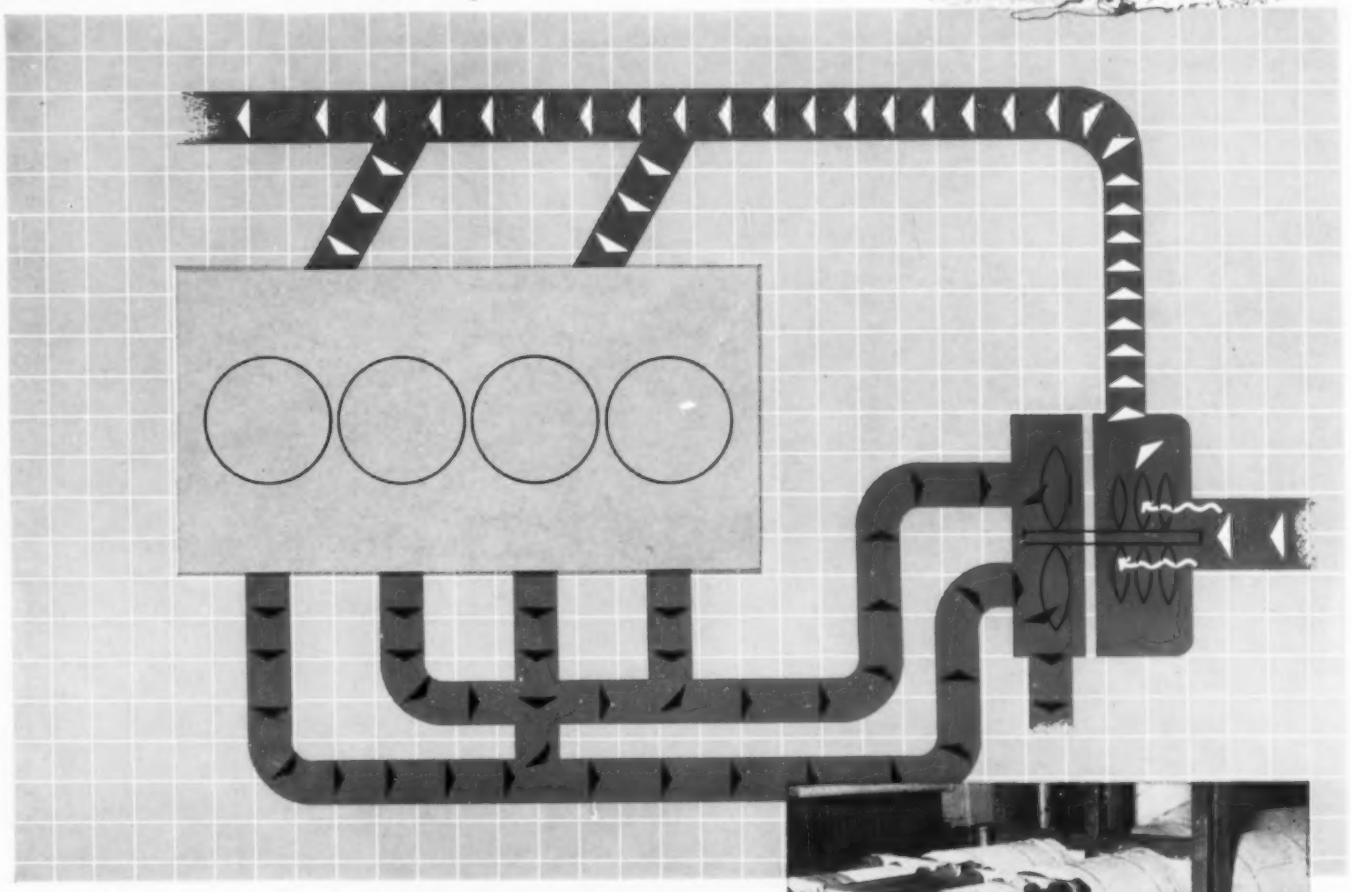
Pneumatic or visual indicators, or both, provide proof of oil delivery. Four models of the system are offered with points of lubrication handled by one unit ranging to 100.

For more data, circle **No. E7** on Readers' Service Card, last page this issue.

Flexonics

has the engineering experience to help you solve exhaust expansion problems when you turbocharge compressors

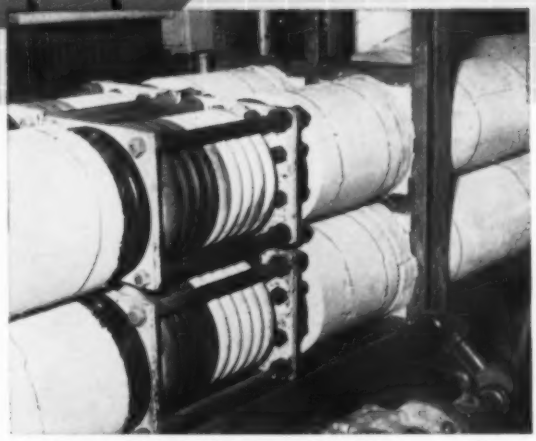




Here's a lively subject – *increasing gas pipeline capacity by turbocharging existing compressors in the field.* If you want the answers to the expansion problems that arise when the exhaust piping becomes an integral part of the operating loop, call on FLEXONICS engineers. They have the *specific* experience in this field that can mean actual dollar savings to you.

Write today for your free copy of this easy-to-read report. It tells you the dollars-and-cents facts that led an important pipeline company to a complete turbocharging program.

EJMA Member Expansion Joint Manufacturers Association



Special-design FLEXONICS Expansion Joints in the exhaust piping of a newly turbocharged compressor station.

EJ-250

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In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ont.

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Please send me a copy of Technical Bulletin No. 175, including the detailed report on the engineering and economic aspects of turbocharging existing compressor engines to increase pipeline capacity.

For more data on advertised products, use Readers' Service Cards, last page.

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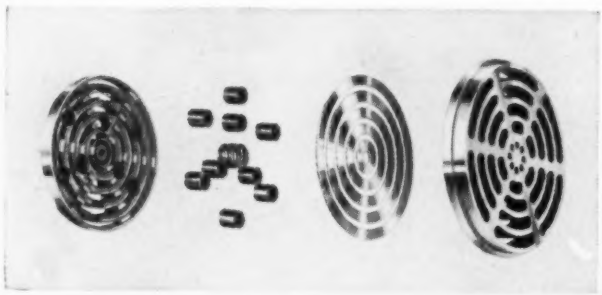
Voss Valves are made to specification, machined from solid stock (not cast)—using best alloy steels; for corrosion condition—stainless steels, such as 410, 18-8 or non-ferrous alloys—monel, inconel, etc. Plates are machined (not stamped) and ground for precise close tolerance fit; are dimensionally stable . . . ductile . . . resist fracture, high temperatures and corrosion . . . withstand fatigue. Springs of heavy rectangular sections and large diameters add to dependability and safety.



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For detailed proposal send name, bore, stroke and speed of machine.

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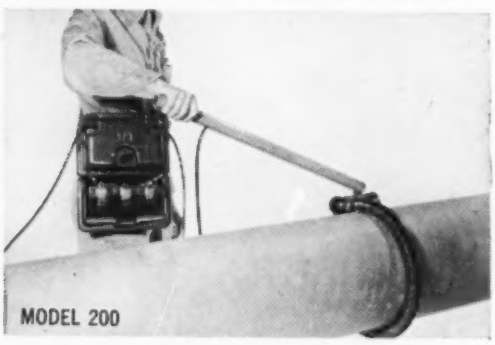

Rugged equipment for dependable holiday detection on ¾" to 36" pipe . . . signal—bell, light and spark . . . unaffected by dew or frost.

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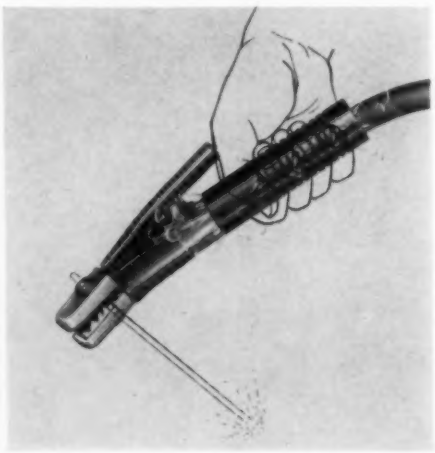
Digital-to-Audio Translator

A digital-to-audio translator accumulator has been developed by Continental Technical Service, Inc. The unit will accumulate, translate and transmit audible or corded data, such as flowmeter or other digital information, from a remote field location to a central dispatching point.

These may be in form of a spoken readout receivable through a standard telephone, or in the form of tones or other code and an appropriate receiving unit. An operator in dispatching center lifts a telephone and dials a number. D.A.T.A. automatically provides a spoken report on the number of gallons or barrels which have passed that remote point. Time required for complete operation is approximately 16 seconds.

For more data, circle **No. E8** on Readers' Service Card, last page this issue.



Electrode Holder

An air-cooled electrode holder for heavy-duty metallic arc welding has been announced by J. B. Nottingham & Co. It will hold electrodes through ⅜-inch diameter and is rated at 600 amps at 40 volts and 60 percent duty cycle.

Air at low pressure flowing from perforations in the handle cools the holder and operator's hand. The holder is the lever-action, semi-insulated type with straight jaws as standard equipment and offset jaws available on order.

For more data, circle **No. E9** on Readers' Service Card, last page this issue.

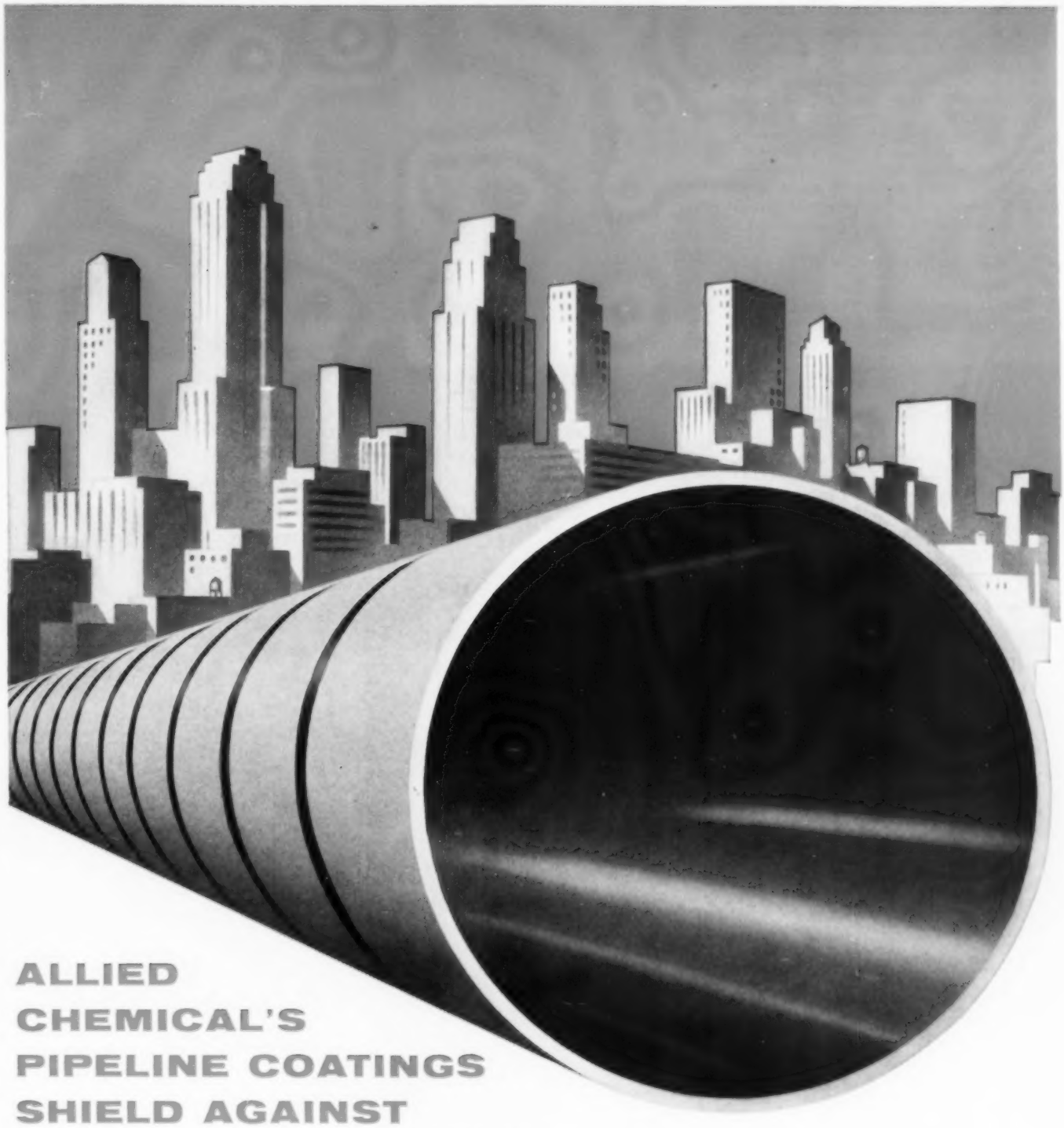
Lube Oil Meter

Providing constant, reliable and automatic records of the amount of lubricating oil consumption, a lube oil meter, Model A, has been produced for the pipe line industry by the Service Recorder Co.

Giving a continuous check of the make-up oil used by big compressors, the unit can be mounted on compressors of all types. It can show if a compressor is not getting enough oil or if it is using excessive amounts and should be inspected to prevent high operation and maintenance costs.

The meters will function on both gravity-fed and pressure-fed lubricating systems. Operators can use the meters to keep records of horsepower hours in computing maintenance efficiency.

For more data, circle **No. E10** on Readers' Service Card, last page this issue.



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Corrosion is costly. The protective coating materials of Allied Chemical offer time-tested protection against the forces of corrosion which eats away at pipeline investments. Proved and improved for three generations — our durable Pipeline Primers, Enamels, and Auxiliary Protective Pipeline Felts — form a maximum barrier against corrosive elements. Get the most dependable coating combination for your next pipeline job. Write to us for full information.

Though we've changed the name from Barrett to Allied Chemical Protective Coatings, you receive the same famous protection in pipeline coatings —proved and improved for three generations.

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40 Rector Street, New York 6, N. Y.

Allied Chemical

For more data on advertised products, use Readers' Service Cards, last page.

Rubber-Tired Side Boom

Designed for use in stringing, lowering-in and other construction and maintenance work on pipe lines, the Blue-Ox Side Boom has been introduced by the FWD Corporation. The unit has a 17,500-pound lift capacity. High flotation tires permit it to operate on city streets without causing damage.

Driver is located behind the boom and the unit can move up to 47 mph. With this high speed it does not require a carrier from one job to the next. Optional equipment includes backfill blade, hydraulic axle stabilizer and 16:00 x 20—14 ply tires.

For more data, circle **No. E11** on Readers' Service Card, last page this issue.

Carbureted Engines

Featuring downdraft carburetion with velocity governor, three new units have been added to the International Harvester Company line of six-cylinder carbureted engines. The UR-372, UR-450 and UR-501 engines have higher horsepower ratings than current models of same displacement.

Maximum hp ratings of the power plants are 165 at 3,200 rpm for the UR-372, 182 at 3,200 rpm for the UR-450 and 212 at 3,200 rpm for the UR-501. Among the features of these units are full-flow oil filter for improved filtration and lengthened bearing life; ease of starting and dependable long-life ignition through improved distributor drive and high-capacity coil, and even-operating temperatures, with elimination of distortion, resulting from use of new high-capacity water pump and revised water circulation system.

For more data, circle **No. E12** on Readers' Service Card, last page this issue.

Magnaflux Materials

For use in pipe line maintenance work, Magnaflux Corporation has introduced availability of its magnaflux particles in handy pressurized spray cans and plastic squeeze bottles. The ready-to-use containers eliminate bulky containers, problems of mixing and application. The new sealed dispensers keep out dust and other foreign particles while storing material. The magnaflux particles are used in testing pipe, valves, engines and other equipment.

For more data, circle **No. E13** on Readers' Service Card, last page this issue.

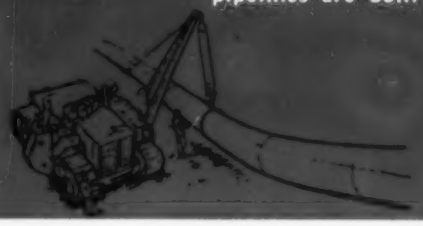
photo from Gray's Anatomy,
courtesy Lonamans Green & Co. Ltd.

OUR VITAL PIPELINES

THE FACIAL ARTERIES — A series of many arteries fed by the carotid arteries. Nourishing the four principal senses of the body: taste, sight, hearing and smell, this intricate system has enabled man, in conjunction with his highly developed brain, to raise himself by his own will up the scale of evolution to civilization.

By supplying energy and raw materials for economic and industrial centers, the pipelines of our country are much like the arteries of the body — as vital to progress as life itself.

From the field direct to the consumer — vital pipelines are built better Majestically.



from the field direct to the consumer

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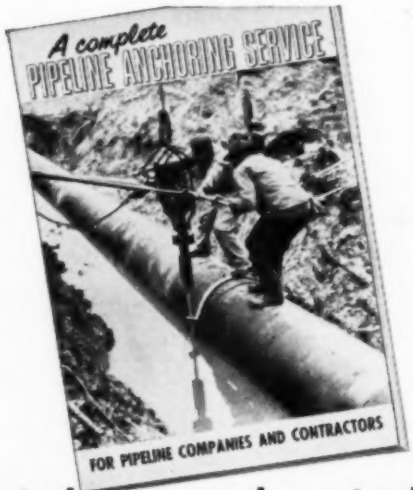

Here's how to solve pipeline floatation problems...

Use the Chance Field Service Plan . . . the surest, easiest, most reliable, and least expensive way to anchor pipelines. You'll cut costs about 85% by using Chance Screw Anchors and tie-down brackets. And, you can have the whole project engineered, installed, and tested by qualified technicians at far less cost than counter weighting.

By making soil test probes, Chance engineers can tell you where anchors should be used, the sizes needed, and the proper depth. To learn how you can get the whole anchoring job done quickly, easily, inexpensively—send or call for this booklet.

Petroleum Equipment Engineering And Services Division Of

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INTERNATIONAL DIVISION • CENTRALIA, MO., U. S. A.

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CHANGES POSITION IN CASING

This versatile and flexible "U"-Seal offers NEW ECONOMY in casing seals.

The special demonstrator pictured shows the flexibility of the "U"-Seal. The pipe position changes, but the seal remains tight. A special fungus and bacteria retardent is added to the compound for extra protection. Seals available in sizes 2" and larger.

VERSATILITY OF INSTALLATION

The fully reversible "U"-Seal is easy to install in the new "U" shape or in WmSon's familiar "Z" shape. A screwdriver is the only tool needed to tighten the two stainless steel bands. Send for technical bulletin.

YOU CAN SEAL WITH A "U"-SEAL

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DOWN

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SIDEWAYS

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New time multiplexing and remote set and reduce line requirements for Du

Five new basic time multiplexing systems—and a new remote index setting feature—add to the overall versatility of *Dur-O-Pulse* . . . give you advantages available in no other telemetering system.

With Time Multiplexing Units—

- You can transmit up to 15 signals either in one or two directions over a single channel.
- You can add intermediate stations without adding any additional transmission lines.

With Remote Set Index—

- Easy to set—set the index, push a button and the rest is automatic: a pulse whose duration is directly proportional to the value of the set point is transmitted to remotely located controllers.
- Can be used as part of a multiplexing system.

- Gives instru
- A sing multip

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The *Dur-O-Pulse* system measures and transmits process variables such as pressure, temperature, flow, level, voltage, current, power and speed. It can send data quickly and accurately over all types of circuits.

set index setting simplify operation Dur-O-Pulse telemetering systems

- Gives you set point indication at transmitting and receiving instruments.
- A single tone is required for the index signal when audio tone multiplexing is used.

Find out about *all* the performance and maintenance advantages of *Dur-O-Pulse* from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

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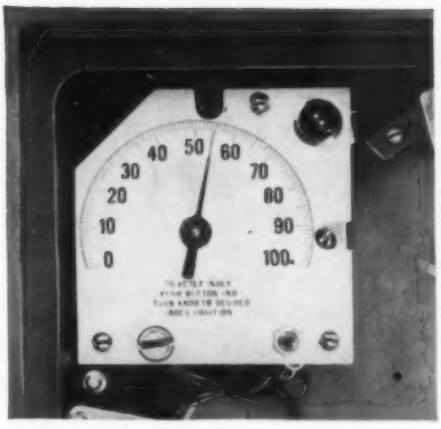
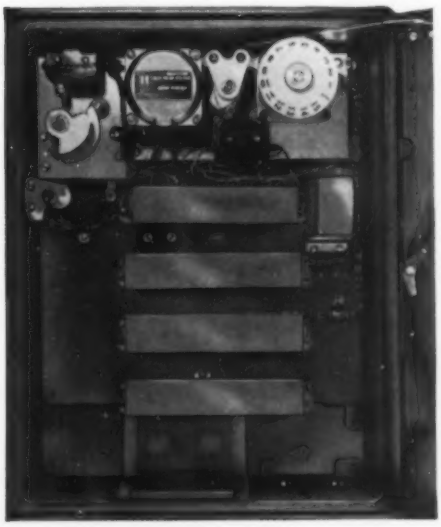
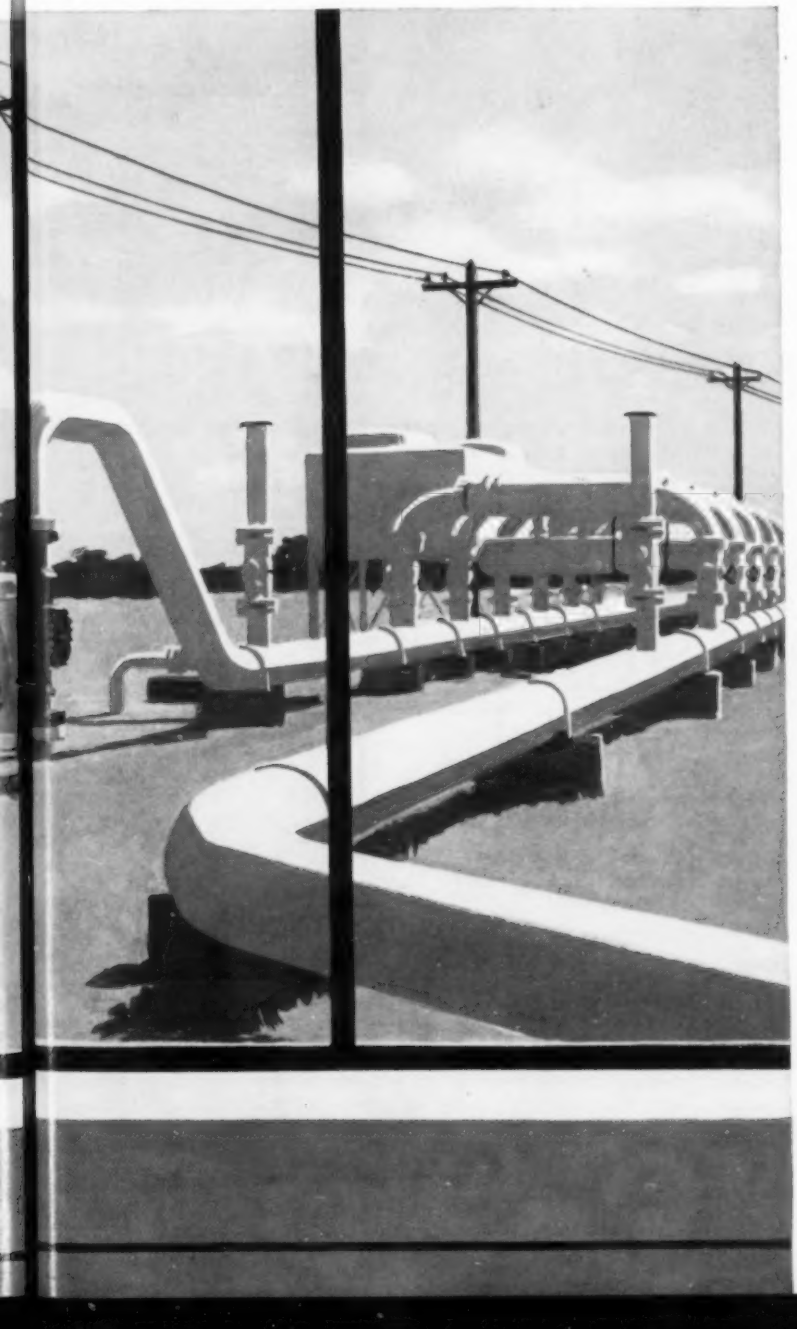


REMOTE-SET INDEX TRANSMITTER eliminates separate push buttons or switches needed to drive controller index up or down scale. To readjust controller index it is necessary only to adjust the indicating pointer to the desired set point and push the start button.



TIME MULTIPLEXING UNITS transmit up to 15 variables in one or both directions and provide a synchronizing signal to keep transmitting and receiving units in step.



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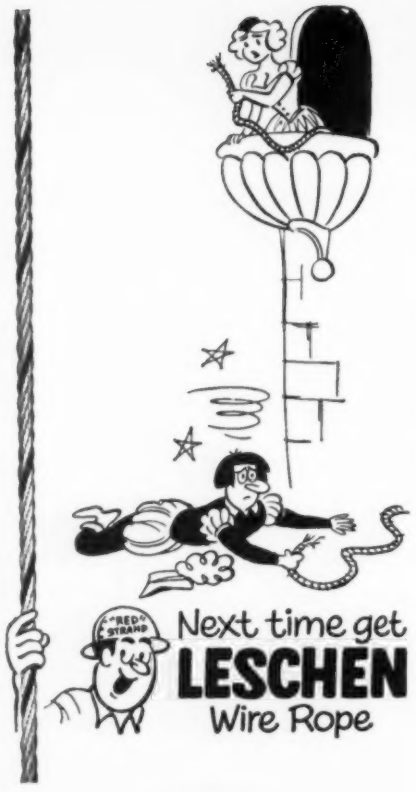
PIONEERING THE FUTURE

Honeywell

First in Control

SINCE 1885



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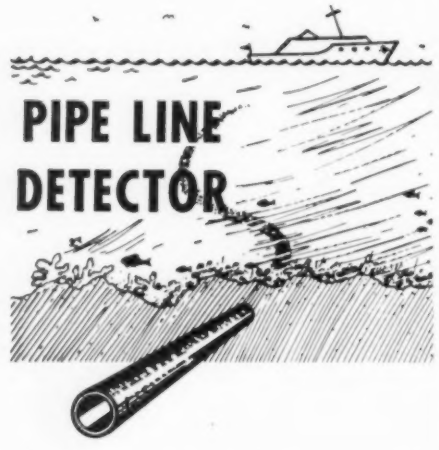

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New Equipment Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers' Index. Simply circle code numbers of items desired—sign and mail card.

Zinc Silicate Coating

A brochure and film covering Amercoat Corporation's zinc silicate Dimetcote coating are available.

The 19-minute, color-sound movie shows uses of the coating and discussion corrosion in general. The illustrated, four-page bulletin concerns Dimetcote No. 3. Dimetcote is a one-coat, spray-on material which bonds to steel chemically as well as physically.

To view the movie contact Amercoat offices in Evanston, Ill., Jacksonville, Fla., Kenilworth, N. J., and Houston.

To get a copy, circle No. **E14** on Readers' Service Card, last page this issue.

Air Compressors

A 10-page bulletin pertaining to its balanced/opposed air compressors has been issued by Clark Bros. Co. The compressors are designed for standard 110 psi industrial use.

Specifications cover the complete line of 23 models. Strokes range from 6-inch to 17-inch and sizes from 75 to 2,000 bhp. Details of the compact, heavy-duty units are described and illustrated in the brochure.

To get a copy, circle No. **E15** on Readers' Service Card, last page this issue.

Lightweight Gas Turbine

General Electric Company has published an eight-page bulletin on its new lightweight gas turbines ranging from 75 to 20,000 horsepower.

Described in the illustrated bulletin are design features, performance and operating characteristics. Some of the features of these units are compact size, design simplicity, low cost and versatility.

To get a copy, circle No. **E16** on Readers' Service Card, last page this issue.

Tractors

Allis-Chalmers Manufacturing Company has released a 12-page catalog covering the D series utility tractor line with its matched equipment. Pointed out are numerous advantages of D series tractors, such as low profile, high clearance, Power-Crater engines, short tuning, easy riding, etc.

To get a copy, circle No. **E17** on Readers' Service Card, last page this issue.

Pressure Gage

Describing the complete line of Type 110 gearcoid Gages, pressure instruments designed for a wide range of applications, a 4-page bulletin has been released by Helicoid Gage Division, American Chain & Cable Company, Inc.

To get a copy, circle No. **E18** on Readers' Service Card, last page this issue.

Earthmoving Equipment

A 20-page, two-color booklet has been issued by Caterpillar Tractor Company on its complete line of earthmoving equipment and its diesel engines. Model views and specifications of graders, tractors, dozers, rippers, traxcavator, pipelayers, industrial engines and other equipment are included.

To get a copy, circle No. **E19** on Readers' Service Card, last page this issue.

Jet Turbine Engine

Describing the concept and operating characteristics of its 10,500 horsepower, RT-248 gas turbine, Cooper-Bessemer Corporation has published an eight-page brochure.

The illustrated brochure reviews development of the engine based on the J-57 jet engine and built by Pratt & Whitney Aircraft. First installation of this unit is planned for Columbia Gulf Transmission Company at its Clementsville, Ky., station.

To get a copy, circle No. **E20** on Readers' Service Card, last page this issue.

Protective Coatings

A 13-page booklet, describing the complete line of coal-tar protective coatings has been published by Allied Chemical Corporation's Plastics and Coal Chemicals Division. This brochure lists detailed specifications, resistance properties and typical uses for expanded cold-applied coal-tar coating line, formerly marketed under the name Barrett.

To get a copy, circle No. **E21** on Readers' Service Card, last page this issue.

Relay Manual

A relay manual featuring 30 types of relays for communications, computers, industry and military, has been published by Diaphlex Division, Cook Electric Company.

Illustrated with photographs, line drawings and tables, the descriptive manual presents detailed data on relays.

To get a copy, circle No. **E22** on Readers' Service Card, last page this issue.

Excavator Crane

Describing its crawler mounted Type K excavator crane, Insley Manufacturing Corporation has issued a 2-color, 12-page brochure. The catalog contains upper works, specifications, working ranges and lifting capacities as well as photos illustrating the newly designed wide vision cab.

To get a copy, circle No. **E23** on Readers' Service Card, last page this issue.

CATERPILLAR ANNOUNCES 2 NEW TRAXCAVATORS

with Power Shift Transmission and Live Action Hydraulics

977H 150 HP 2½ cu. yd. bucket

955H 100 HP 1¾ cu. yd. bucket

There is a way to beat higher costs—and that's with increased production. For tractor-loader jobs, here's your answer in the new Cat Series H 977 and 955 Traxcavators. Designed to set a pace far faster than the models they replace (and other makes of comparable size), they're milestones in tractor-loader progress. With power shift transmission and Live Action Hydraulics, they're *the loaders that never stop.* Get the facts about them from your Caterpillar Dealer. Ask for a demonstration, too. See for yourself how they set new production figures on the toughest kind of job.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

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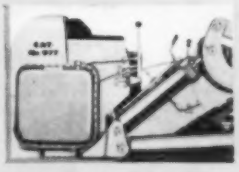
TRAXCAVATORS ARE MAKING OTHER LOADERS OBSOLETE

NEW FEATURES SPEED LOADING, LIFTING, HAULING, DUMPING . . . THE FULL CYCLE

NEW POWER SHIFT TRANSMISSION. One lever—that's right, one lever gives split-second changes in speed or direction to slash cycle times and increase operator efficiency.



NEW LIVE ACTION HYDRAULICS. Provide faster lifting speed and greater lifting capacity without robbing power from the tracks.

MORE HP WITH NEW CAT TURBOCHARGED ENGINE. Up 50% on the 977H—up 43% on the 955H.

NEW INCREASED BUCKET CAPACITY. An 11% increase on the 977H—a 16.6% increase on the 955H.

NEW HEAVY-DUTY UNDERCARRIAGE. Larger, stronger track components also increase stability . . . lifetime lubricated rollers with exclusive floating ring seals need no servicing.

MORE HIGH-PRODUCTION FEATURES. New gasoline starting engine . . . new dry-type air cleaner that cuts maintenance time as much as 75%. Plus such retained features as 40° bucket tilt back . . . automatic bucket positioners and kick out . . . hydraulic track adjusters.

QUICK-CHANGE ATTACHMENTS. Multiply the usefulness of these machines. Attachments available include the Side Dump Bucket, Rock Bucket, Quarry Bucket, Bulldozer, Ripper and Log and Lumber Forks.

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RECTIFIERS

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Ask your Representative about the entirely NEW concept in Cathodic Protection! The Good-All

"AMP-O-MATIC"

Rectifier. Just set it and forget it . . . the Amp-O-Matic automatically ADJUSTS OUTPUT ITSELF!

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OGALLALA, NEBRASKA

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M-SCOPE PIPE FINDER

only

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New, Heavy Duty LEAK DETECTOR . . $295.00

Send for FREE 1960 Catalog.

FISHER
Research Laboratory, Inc.
Dept. PI-4, Palo Alto, California

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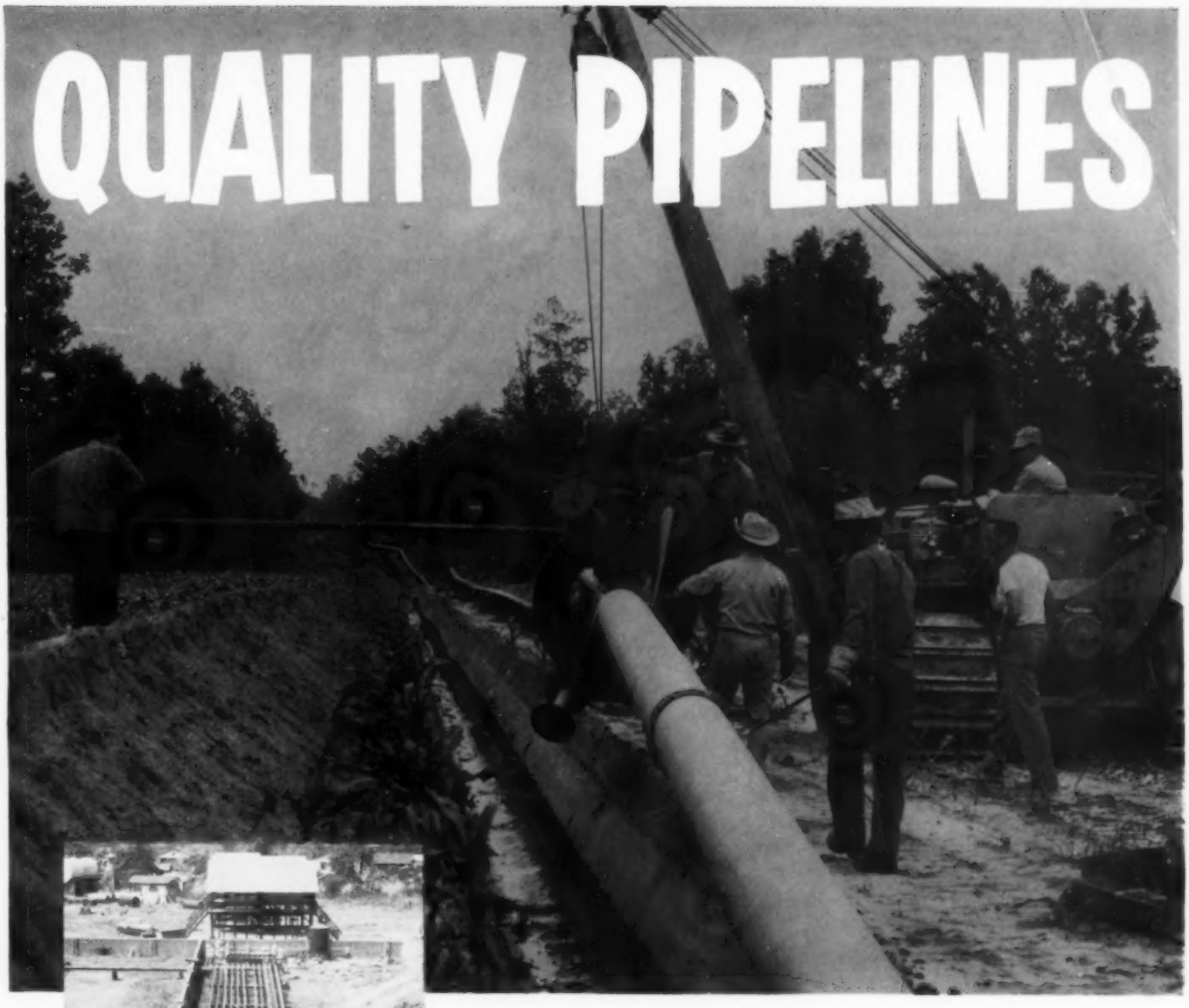
THE GO-DEVIL — READY TO GO!

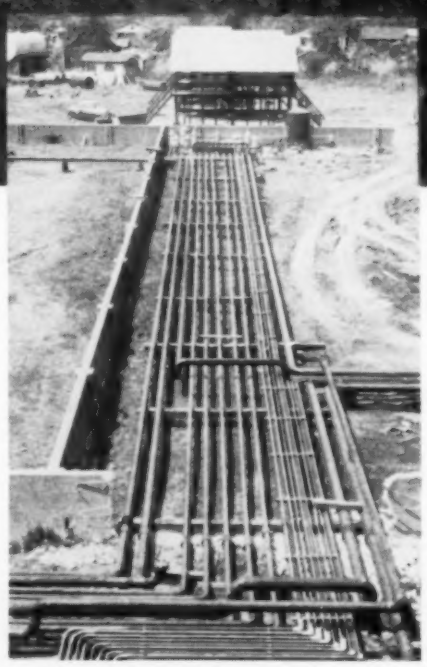
Partly compressed guide arms and knives are held tight but flexible against pipe walls by pressure of individual springs. Guide arms keep scraper in line, eliminating undue driver wear and prevents cocking. Flexibility permits Go-Devil to round bends.

Go-Devil

G. A. COTTEN CO. P. O. Box 5332 Tulsa, Oklahoma

QUALITY PIPELINES





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LATEX QUALITY LINE CONSTRUCTION

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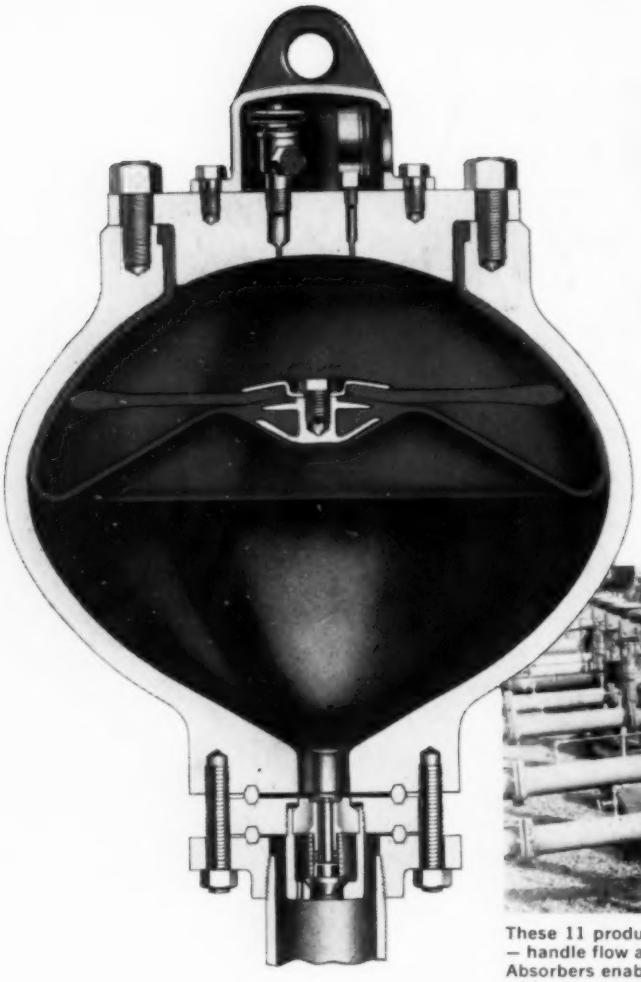
LATEX CONSTRUCTION COMPANY

P. O. BOX 12128 • ATLANTA 5, GEORGIA • CE 3-9414

prolongs life of pipelines, fittings and pumps... saves downtime... cuts maintenance costs!



These 11 product transfer lines — some over 1,000 feet long — handle flow at the rate of 1,600 gpm each, yet Hydril Surge Absorbers enable them to be closed in a fraction of a second without over-pressuring lines, fittings or metering equipment.

HYDRIL TYPE "K" SURGE ABSORBER

smooths out shock and pulsation in pipelines

QUICK-CLOSING VALVES and piston-type pumps punish pipelines by imposing sudden peak pressure loads. Unless these surges can be absorbed or smoothed out, pipe and fittings are exposed to stresses which may cause costly failure.

Hydril Type "K" Surge Absorbers are successfully controlling many types of line surge and pulsation in petroleum product handling lines, water pumping systems and oilwell repressuring programs. Simple design and construction assures long, trouble-free operation. This same oil field-proven Hydril design has been used for many years as a pulsation dampener on high-pressure oilwell mud pumps. Servicing, though rarely required, is readily performed without special tools and without shutting down the system or removing the unit from the line. Available in a wide range of sizes and pressure ratings.

Another dependable Hydril pressure-control product

For more detailed information on Hydril Surge Absorbers, consult your Pipeline or Composite Catalog . . . or call your Hydril Representative

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